MODEL AIRPLANE NEWS

REMOVABLE SCALE WINDSHIELDS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

48120

Buyers' Guide

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Models that Bounce

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October 1997

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Reviews: Wing Mfg. **B-25** • Lite Machines **100+** • Midwest **CAP 232** • MDS **.61**

MODEL AIRPLANE NEWS

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Member Audit Bureau of Circulations

PRINTED IN THE USA

OCTOBER 1997 • VOLUME 125, NUMBER 10

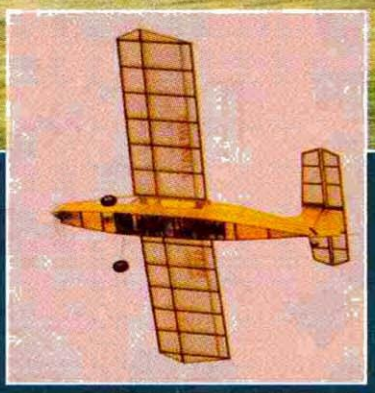
MODEL AIRPLANE NEWS

Features

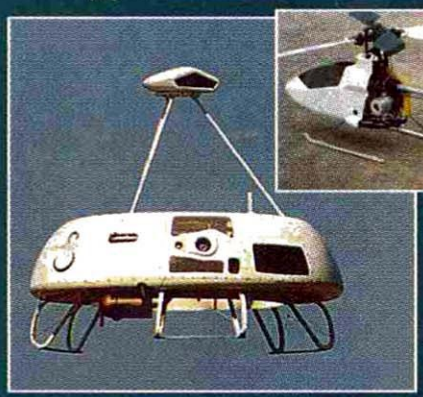
Construction

Departments

▲ *Midwest Cap 232 —page 36*



▶ *Modelair-Tech Dimwatt —page 42*



▲ *Lite Machines 100+ —page 66*

◀ *Final Approach —page 186*

ON THE COVER: *main photo—Wing Mfg. B-25 takes off on another mission (photo by Walter Sidas). Products: Thunder Tiger flight box, Airtronics Radiant, O.S. .40LA, Top Flite Bonanza, Hitec HS-85 servo.*

Reviews

Columns

EDITORIAL

by LARRY MARSHALL

ARFs...TOOLS FOR THE MODELER

My June '97 editorial ("Are you a Lifer?") generated a lot of positive response. It's clear that many of you are thinking about the issues surrounding our hobby's growth, and it's clear that there's still a very strong foundation of dedicated modelers helping people find their niche in our great hobby.

The reason I mention this is that several of you suggested that people don't become more involved in our hobby because of ARFs (almost-ready-to-fly models) and that these pre-built planes are why we see people leaving after a couple of years. ARFs have done so much good in getting people into the hobby quickly that I find it hard to understand this view.

Some argued that they are too expensive, but kits are available if money is the object. Some said that there's no pride in ownership of an ARF. As a modeler, I am sensitive to this idea, but those who choose to buy ARFs are looking for something to fly with a minimal time investment.

Some suggested that ARFs don't teach much about model construction. While this is true, this is exactly why they've become so popular as entry-level and general sport aircraft. There's nothing to prevent an ARF flyer from learning to repair models from the many club members who would be willing to help him, so I don't buy into the idea that this is why people leave model aviation.

In fact, ARFs continue to be very popular, and an argument can be made that they have been very influential in getting a lot of people to try R/C; if you can get people into the R/C fray, why is it hard to keep them there?

The people who wrote to me about ARFs felt pretty strongly about what they were saying. Why? Could it be the perspective from which they and possibly others view ARFs? Could it be that a bit of lateral thinking is required to see the role of ARFs in a modeler's world? Could it be that ARFs can actually improve a modeler's abilities to enjoy the other aspects of the hobby? I think the answer to each of these questions is yes!

The Kyosho Spacewalker ARF makes a great weekend flyer.

We often hear people say that they don't have time to build models. We live in a world where time is always in short supply and because of this, fast-food restaurants abound. But does that mean we never head to a nice restaurant for a good bottle of wine and a nice, leisurely dinner? Should we approach R/C in a fast-food-only manner?

We R/C nuts like to have something to fly, right? So for some, the answer is to fly an ARF and say, "I don't have time to build that nice scale model I've been dreaming about." But ... is it written somewhere that you must build that scale airplane in 6 months? Of course not, but people are driven to that view by the need to have something to fly, so they're driven to build quickly or not at all.

Why not fly ARFs while you thoroughly enjoy the construction phases of that scale project? If you only have a small amount of building time per week, savor it, watching your project slowly take shape. I guess my point is that ARFs, like any other type of model, have their place. It's only when we start thinking of things as good or bad and better or worse that we lose sight of the idea that maybe we can benefit from using both.

1997 BUYERS' GUIDE

If you're someone who flies ARFs, and you're looking for a kit, or you're a modeler who's looking for an ARF to fly, we're bringing you some help in the form of our *1997 Model Airplane News Buyers' Guide*. Though not an exhaustive listing of the marketplace, it presents more than 350 of the top R/C airplane products, and one of them might be just what you're after. We've also provided an up-to-date index of manufacturers' addresses and phone numbers to make it easy to obtain more information.

EPP FOAM CONSTRUCTION

We and Dave Sanders are pleased to provide you with information on building with EPP foam. This is the stuff that the slope-combat guys use to make scale planes that bounce. We're going to see this material being turned into trainers and sport planes; Dave shows you how.

AirSCOOP

by CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

GIANT GOLD IS HERE!

How many of you have been wondering whether Top Flite would ever offer their high-quality Gold Edition Series kits in giant-scale, IMAA-legal sizes? Well, the suspense is over. Top Flite has kicked off the giant series with this beautiful North American P-51D Mustang. From what I'm told, like previous Gold Edition kits, the new big kits will feature precision-cut parts, excellent balsa, CAD-drawn plans and everything else that goes with the name "Gold Edition." Mustang specs: wingspan—84.5 inches; wing area—1,245 square inches; length—73.5 inches; weight with radio—17.5 to 19 pounds; wing loading—32 to 35 ounces/square foot. I predict the P-51 is only the tip of the "Giant-Gold" iceberg. For more information, contact Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61820.

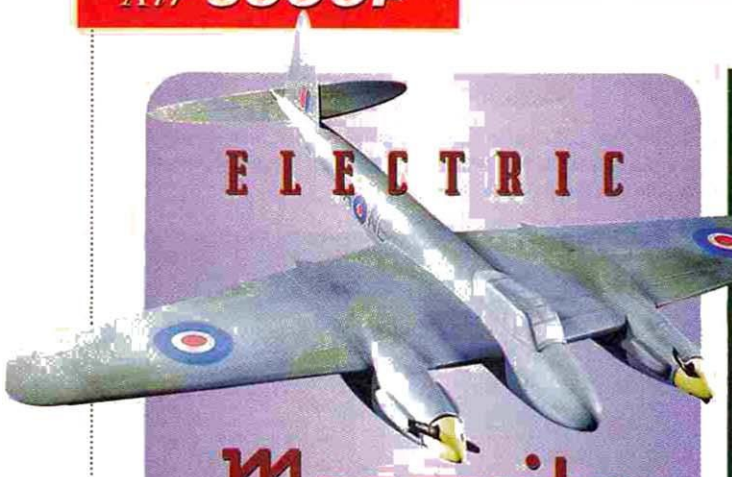
Ultimate Waco?

Proctor Enterprises is touting this beautiful German kit from Flugmodellbau Barth as "the ultimate Waco"—and it may well be, as far as kits go. This all-wood, 1/3-scale kit of the YMF-5 spans 118 inches and weighs 38 to 40 pounds. I must say, kit features are indeed impressive. Engine cowl, wheel pants, ailerons (four), fairings and pilot headrest are all finished and finely detailed in fiberglass. The landing gear and upper wing supports are pre-bent and soldered, and—check this one out!—the rudder and elevators are mounted on ball bearings! For quick field assembly, all four outer wing panels are mounted on aluminum tubes. The kit includes all the necessary hardware, including metal fittings, flying wires and landing-gear wires and operational turnbuckles. For more information on this Golden Age beauty, contact Proctor Enterprises, 25450 N.E. Eilers Rd., Aurora, OR 97002; (503) 678-1300.

NEWS FLASH!

Thunder Tiger Buys Ace R/C

Ace Radio Control Inc. has announced that Thunder Tiger Taiwan purchased its operations on June 16. The new entity is known as Ace Hobby Distributors Inc. According to an Ace press release, policies and procedures for Ace dealers will remain the same. The company plans to publish a new catalogue that will include new lines, but in the interim, dealers may order from the 1996 catalogue. Based in Higginsville, MO, Ace R/C has been in business since 1953. Founded in 1979, Thunder Tiger has its headquarters in Taiwan and has a U.S. subsidiary in Dallas. For more information, contact Ace R/C, 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037-0472; (816) 584-7121; fax (816) 584-7766.



ELECTRIC Mosquito

Leave it to Hobby Lobby Intl. to offer a Speed 400-powered de Havilland DH-98. Thank you! This 48-inch-wingspan rendition of the legendary British Mosquito fighter/bomber has a lightweight, one-piece, fiberglass fuselage assembly and plug-in, built-up-balsa, outer wing panels. The model can be assembled quickly and is reportedly easy to fly, yet fast with good aerobatic performance. Using an 8-cell 1700mAh battery

pack, a duration of 6 minutes at full power is claimed. Specs: wing airfoil—NACA 2409; wing area—366 square inches; weight 48 ounces; wing loading 19 ounces/square foot. Flight-control functions required: throttle, ailerons (two servos required) and elevator. Hey, Hobby Lobby guys! ... how about a P-38, a B-24, a B-25, a B-17, an ME110, a B29, a B-39 .... I want them all!

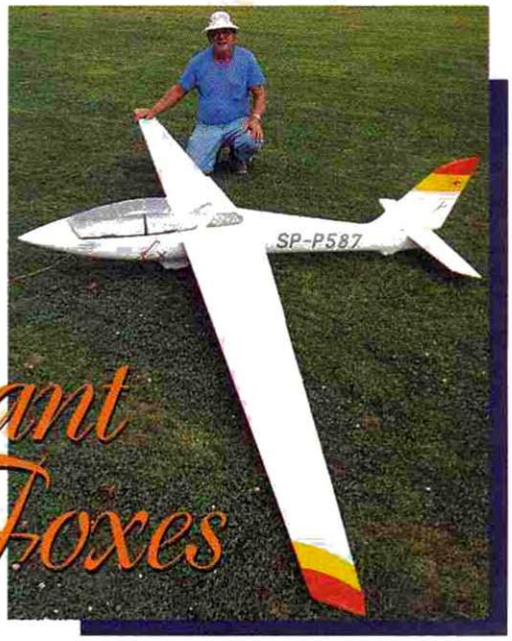
For more information, contact Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

Spirit of St. Nick

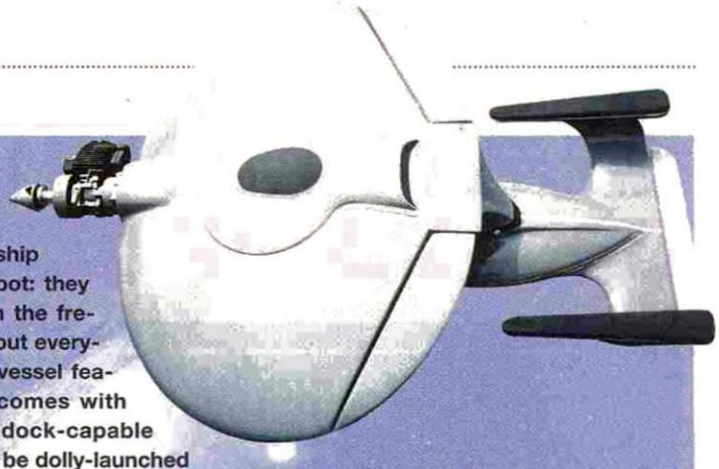
That's right; Mr. Ziroli has a giant Spirit. To commemorate the 70th anniversary of the historic transatlantic crossing by Charles Lindbergh, Nick Ziroli Sr. has completed work on a ¼-scale Spirit of St. Louis. The Spirit has a 138-inch wingspan with 2,460 square inches of area. Construction is built up using mostly clear pine; balsa is used for the wing ribs (24 in each panel), tail ribs and nose planking. The prototype, shown here, is equipped with a 4.2ci American 70 and guided by an Airtronics Infinity radio. The model will be finished using Model Graphics numbers over Stits covering and finish from F&M Enterprises. Robart Mfg. is providing scale landing-gear and support-strut assemblies. For more information, contact Nick Ziroli Design and Engineering, 605 East Monroe St., Little Falls, NY 13365; (315) 823-1208.

Elegant Foxes

Sailplanes Unlimited stocks three versions of the sleek, two-place Fox that's the sister ship of the single-place world aerobatic champion, the Swift. The Swift took 15 places out 61 in '95 World Champs. The first kit is a ⅓.75-scale, 3.8-meter (149-inch-span) version from Roedelmodell. It comes with a white epoxy/glass fuselage and obechi-covered wings, rudder and stab. Spoilers are partially installed, and control-surface cutouts are balsa-faced. Next is a ⅓-scale 4.66-meter (183-inch-span) version from PriBek; it features a white, epoxy/glass fuselage, installed wing-joiner tubes, obechi-covered wings and tail surfaces and installed spoilers. The last version from Schuler & Fleckstein is also ⅓ scale, but the fuselage and all the surfaces are epoxy/glass and come finished in scale colors of orange, yellow and red. This model features hinged ailerons, installed spoilers and installed servo boxes. For more information on these three models, contact Sailplanes Unlimited Ltd., 63 East 82nd St., New York, NY 10028; (212) 879-1634; fax (212) 535-5295.

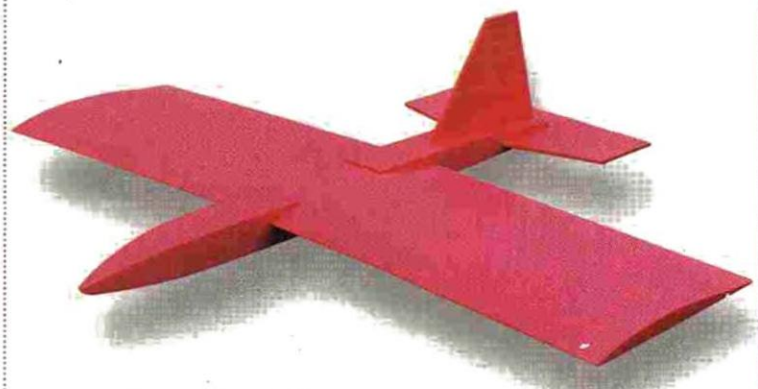


... Phasers not included



Next time those Romulan modelers cross the neutral zone into your flying space, send Starship 2000 to meet their threat! (Romulans are easy to spot: they love doing touch-and-goes in the pits, never return the frequency pin and know everything there is to know about everything.) For durability and ease of construction, this vessel features 98-percent-fiberglass construction, and it comes with plans and instructions. To save on costs, space-dock-capable hardware was left off the Starship. This version must be dolly-launched (dolly plans included) and belly-landed—"Fascinating!" Specs: wingspan—41 inches; length—56 inches; flying weight—14 pounds; engine size (when using 5-percent to 15-percent "dilithium-crystal solution" fuel)—30 to 60cc. For more information, call (205) 974-1304 (ask for Mr. Data). The Starship 2000 can be ordered directly from Premier Distributing, 620 CR 324, Moulton, AL 35650; (205) 974-1307.

"Make it so" R/C



Personally, I believe you can never become a truly great pilot without taking risks, and the Sniper is just the plane to bring out the "Braveheart" in you. Designed for combat slope soaring, JK Aerotech's Sniper™ is made of CNC-cut pink foam and packing tape in typical "foamie" fashion. This 42-inch-wingspan design is rugged and highly maneuverable and will handle those turbulent and gusty conditions that the slopes can dish out. But wait! Here's the best part. It's only $20!—very easy to be brave at that price. To personalize your Sniper, packing tape in six colors is available from JK, as is a handy tape machine that, according to the manufacturer, really helps in the construction of this type of model. An .049 to .09 glow-powered version is also available. For more information, contact JK Aerotech, 5120 E. Powell, Gresham, OR 97080; (800) 442-6755.

Have courage! It's cheap!

Secret Weapon ERRATA

Seems like yours truly took the "secret" part of the name a little too seriously and fed you guys some "disinformation" in my July "Air Scoop." The Secret Weapon is NOT one of LDM's Combat Series. The Secret Weapon is a new .15-size open combat model that features a wing that's forward-swept to enhance maneuverability and has a plywood-laminated leading edge for maximum streamer cutting and enemy-plane-dicing capability. The forward-swept, plywood-reinforced, vertical fin was also "combat-conceived." In actual combat, the prototype Secret Weapon is reported to have completely sliced through another combat plane and kept flying!—and it has the scratch marks to prove it. Specs: wingspan—36 inches; fuselage length—24 inches; wing area—325 square inches; flying weight—20 ounces. For more information, contact LDM Industries Inc., P.O. Box 292396, Tampa, FL 33687-2396; (813) 991-4277; fax (813) 991-4810.

AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 100 East Ridge, Ridgefield, CT 06877-4606; email **man@airage.com.** Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we can not respond to every one.

AERO .35

How can I get more information about Aero Research and Development and their Aero .35? I cannot get that engine out of my mind; it is strikingly beautiful. Did it fail because of marketing or mechanics? I am a machinist and would love to have a go at reproducing the prototype that was fabricated of bar stock.

ROGER PERRONE
Versailles, KY

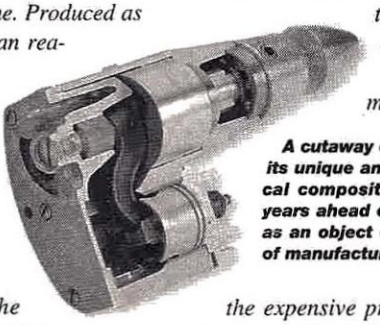
Roger, I totally agree with your assessment of the Aero .35. I am pleased that one of its designers, John Piston, is my friend. Sadly, John's collaborator, Augie Savage, passed away several years ago. Here's some background information concerning their fascinating engines:

The result of extensive experimentation both before and after WW II, the Savage .60 emerged as their first marketed horizontal-piston engine. Produced as a spark-ignition type, it ran reasonably well, but experienced overheating problems because of its rearward-facing cylinder. Coincidentally, Ray Arden's glow plug was introduced the same year (1947). History confirms that the new glow-plug engines quickly destroyed spark-ignition engine sales; this paradigm shift signaled the beginning of the ½A revolution and a general trend toward smaller displacements. As luck would have it, Savage and Piston, like many other postwar manufacturers, were heading in the wrong direction. Fewer than 50 Savage .60s were produced.

Unlike most others, they didn't go out of business, but learned and adapted to the new technology. For more than 10 years, they continued to experiment with revised designs (more than a dozen), until the breakthrough engine of 1959. This .29ci bar-stock engine proved a tremendous success, leading directly to the production design. Harold deBolt, who had been helping to evaluate their engine's performance, convinced them that a larger displacement was necessary to meet the needs of the emerging R/C industry. Ultimately, the production engine was enlarged to .35ci.

Between the years 1963 and 1969, the Aero .35 was produced by Augie's company, Aero Research and Development Co. Inc., of Buffalo, NY. The production engine combined many advanced features, including first-type Schneurle porting, steeply angled transfer ports (later patented by SuperTigre), a flat-top, baffleless piston and a hemispherical combustion chamber. Its reduced frontal area promised increased aircraft performance by decreasing profile drag. The engine could be purchased as control line or R/C—only the interchangeable carburetors were different. Both versions performed admirably, producing power and operating characteristics similar to the popular Fox .35 Stunt ($14.95). Regrettably, the engine wasn't successful in the marketplace; modelers complained about the price—$34.95.

Aero Research was eventually forced to file for bankruptcy. As part of the settlement, the government required that all the expensive production tooling be destroyed. Several early experimental engines still exist, including the bar-stock prototype (.29ci). Unfortunately, the technical drawings were destroyed along with the tooling.



A cutaway of the Aero .35 shows its unique and ingenious mechanical composition. The engine was years ahead of its time and served as an object of study by a number of manufacturers.

Savage, outraged by lack of support from the modeling community, refused to acknowledge its existence for the remainder of his life. Although saddened by the demise of the Aero .35, John Piston, now in his 70s, continues to invent engines, design futuristic airplanes, travel and enjoy life. Dave Gierke

ELECTRA

Lately, much attention has been given to Amelia Earhart's around-the-world attempt in that Lockheed Electra Model 11. What a beautiful bird that plane was (alas, a great scratch-building project).

The only plans available for this plane were drawn in 1936 by Cleveland Models—a 27-inch rubber-powered job. They now offer you an 81-inch-span just by blowing up their original prints: hardly a suitable airframe to support a pair of .15s (or more).

Please, where can I get my mitts on a better set of plans for this plane—48- to 96-inch range would be dandy.

BUZZ BORDEN
Deland, FL

Sorry, Buzz. We've racked our collective brain here at Model Airplane News *and don't know of any available plans for this historic airplane, although we're sure one must be out there somewhere. We leave your request in the capable hands of our readership. If anyone knows of plans for the Electra, would you kindly write to Buzz, c/o* Model Airplane News*? Many thanks.* DS

SCRATCH REVIVAL

In Hal deBolt's June 1997 "Golden Age of R/C" column, there was a photo of a Live Wire Champion Mk IV. I'm a big fan of the LW Champs, and I'd like to get hold of this new and improved version. Any word on when these plans will be available, and from whom?

RON NEILL
Via email

Ron, thanks for asking. A lucky find at a garage sale turned up some model supplies that included a partially built LW Champion Mk III (circa 1981). It was love at first (or second or third?) sight. My decision to build the kit was immediate. A number of design changes were made. These included a bolt-on wing, tricycle landing gear and a very different engine mount system.

The 4-pound model flies well using an O.S. .20. My son, who hasn't flown R/C for over 20 years, and my 12-year-old grandson, who had never flown, flew the Champ unassisted (except for takeoffs and landings). Their flights were about 10 minutes long, and only once did the instructor step in to bring the model back upwind. Obviously, the Champ is an ideal trainer.

The LW Champion Mk III plan is available from John Pond's Old Time Plans Service, P.O. Box 90310, San Jose, CA 95109; (408) 292-3382. A partial full-size plan (18x24 inches) showing the revisions is available from me for $3 at 82 Frazier Way, Marstons Mills, MA 02648. George Wilson

Pilot PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1997. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606.

LUFTWAFFE FIGHTER

Guy Newberry of Destin, FL, built this 80-inch-span Focke-Wulf FW-190-A8 from Bob Holman plans. He added every conceivable surface detail, including recessed panel lines, blisters, hatches, surface screws, airbrushed insignia and between 30,000 and 40,000 rivets. Guy writes, "After two years of devoting nights/weekends and all in between, I managed to keep my wife and my sanity!"

MULTI-MOTOR FLYING BOAT

Wesley Davis of Tucson, AZ, spent three months scratchbuilding this 1/24-scale, 1929 Dornier DO-X. The 79-inch-span model taxies with six of the 12 electric motors shut down, and Wesley says that the 15-pound craft is underpowered with 24 amps at 12 volts and 7.5x6 props.

"E" IS FOR EXCELLENT

This 1/5-scale Gee Bee Model "E" was scratchbuilt by Steven Bohl of New Berlin, WI, from Henry Haffke plans. The 72-inch-span model is covered in MonoKote and uses an O.S. .91 4-stroke for power. Steve equipped the model with a working Star Pathfinder compass, which was used in the full-size Gee Bees during their racing days.

GRUMMAN DUCK

Pierre Uyttenhoven, a retired Belgian airline pilot, built this J2F5 model of the airplane featured in the movie "Murphy's War." The 6½-foot-span model features retractable landing gear, a stainless-steel, retractable tailwheel and a stainless-steel, homemade rudder. The main float is made of fiberglass, and the rest of the model is standard balsa, pine and ply construction covered with Solartex and dope. The 33-pound model is powered by an O.S. FR300 5-cylinder engine.

EXTRA NICE

Phil Vernon of Davenport, IA, built this Rich Uravitch Extra 3.25 from *Model Airplane News* plans. It's covered with Solarfilm and handcut stripes and lettering, and Hitec sub-micro HS-80 servos help keep the weight down to 2½ pounds. Phil painted "Extra 3.28" on the model's wing because he powers it with a Magnum 28 XL.

LIGHTS, CAMERA, ACTION!

Bill Mol of Austin, TX, built this Top Flite AT-6 kit, covered it with Oracover and added a Williams Bros. pilot that was painted and dressed like a Japanese pilot/actor. Powered by a Magnum 1.08 2-stroke engine, the model has a fantastic climb rate and a really fast roll rate. Bill flies with the Hill Country Aeromodelers in Austin.

DOUBLE TROUBLE

John Pellerin of Sulphur, LA, modified this Sig Four Star 40 kit by making it a twin. He custom-built the nacelles to hold two Magnum .28 XL engines; customized the model's nose; added flaperons; lowered the horizontal stabilizer; enlarged the rudder; and custom-made spinners. John says, "The Double Trouble's first flight was my first on a twin-engine plane. It scared me to death. ... Since then, I have burned more than a gallon of fuel in it."

OH, MEXICO

Andy Younker of Prescott, AZ, sent this photo of himself and his Midwest CAP 232 at a fly-in in Mexicali, Mexico. Andy covered his model with Supercoverite cloth and decorated it with automotive paint. A SuperTigre 3250 spinning an 18x8 Zinger prop keeps this plane in the air.

WW I DOGFIGHTER

The winter project of Ken Bell of Fontana, WI, this SE5a has a 60-inch wingspan and weighs 9 pounds. It's powered by an O.S. .61 engine, is covered with Easytec fabric and has Williams Bros. guns and wheels and Major Hobby Decals. Ken scratch-built the model from Tom Connor plans and equipped it with pull/pull rudder and elevator control.

1/6-SCALE TROJAN

Bill Bailey of Sumner, WA, built this T-28B from Pica plans. The model has retractable main gear and steerable nose gear, is covered with MonoKote and uses a .71 SuperTigre engine for power. All the control surfaces are servo-controlled, with 11 servos total used on the model. The Trojan weighs in at 9½ pounds.

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

WING MFG.

B-25

by CLIFF BECKER

THE NORTH AMERICAN B-25 Mitchell medium bomber is perhaps one of the most famous twin-engine aircraft of WW II. Movies such as "Catch 22" and "30 Seconds Over Toyko" have brought the B-25 star billing in the eyes of many modelers and aviation enthusiasts. Wing Mfg.'s* B-25 kit—with its wingspan of 84 inches—is in the "just the right size" category. Smaller kits tend to have high wing loadings and thus fly much too fast, while the giant-size kits are simply too big to be easily transported to the field. Add to this the kit's strong, well-thought-out design and the many scale accessories included, and you have a very attractive scale package.

The kit includes all necessary nuts, bolts and screws. The many ABS formed-plastic parts speed construction, and the full-size plans supply a wealth of construction information. The B-25 requires an experienced builder and flyer, however. If you meet this requirement, you're in for a great project.

CONSTRUCTION

There are three sections to the wing due to its gull-like configuration. The foam-cores are smooth and sharp, and their edges can be handled easily without damage. The core sections lined up with each other very nicely when the plywood inserts were installed and glassed into place. I used fiberglass tape and resin to strengthen all the core butt joints. While the glued-up cores were curing, I joined and glued the wing skins together. I used a 3-foot-long sanding block to square up their edges so they would fit together without any gaps. I used Ambroid glue because it sands out smoothly, unlike CA. The only disadvantage is that Ambroid must be left overnight to dry. While the skins were drying, I cut the channels in the cores for the servo wires and set up all the pushrod cables. I used a pre-formed cutting wire in my soldering iron to form the channels. I then applied epoxy to all the cutout areas for strength. To apply the wing skins, I used Dave Brown* Southerner sorghum contact adhesive. Once the skins were in place and had cured, I added the leading and trailing edges and began to cut out the control surfaces. If you have access to a copier, copy the plans in the flap and aileron areas. Cut them out and tape them to the wing to give you an exact cutout template. Once cut out, all surfaces are shaped, sanded and hinged, and 1/16-inch plywood shields are applied to the top of the wing to cover the LE gap area of the flaps and ailerons. When the shields are in place, make sure all surfaces move freely. Now set aside the wing and start the horizontal stabilizer.

THE TAIL

The same method is used to cover the foam horizontal and vertical stabs, but the tricky part is installing the central control cable for the rudders. When all pushrods are in place, sheet and then sand the

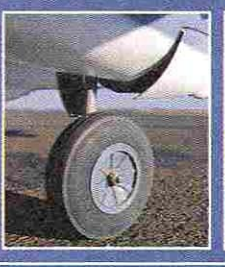
h-span Mitchell bomber

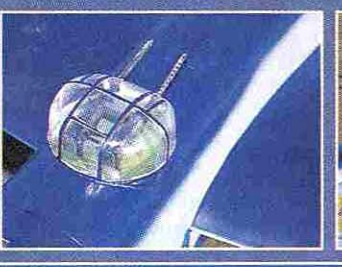
stabs to final shape. The rudders are built up with balsa ribs and then covered with fabric. Once sanded to shape, they look very authentic. When the rudders are complete, fit them to the vertical stabs. Now fit the elevators to the horizontal stab and check that the hinges and linkages all move smoothly. When you are satisfied, set the tail aside until you're ready to attach it to the fuselage.

ENGINE NACELLES

I was apprehensive about the construction and attachment of the nacelles to the wing, but everything worked out very well. All the plywood parts are laser cut, and they just fall out of their stock sheets and fit perfectly together. Construction steps are easy to follow because Wing Mfg. spent a lot of time developing their instructions and plans so that everything fits together. I'm glad they did. The finished nacelles are very accessible to work on. The firewall can be unbolted and removed, allowing you full access to the interior of the nacelle to get at the fuel tank and throttle servo.

The plans and instructions are well-thought-out, especially in expiaining how to make the mechanisms that open and close the gear doors. The kit supplies





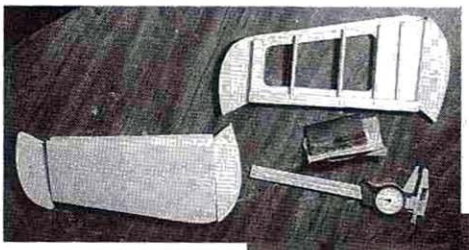
PHOTOS BY WALTER SIDAS

wing offset hinges that help create the proper geometry, and the supplied diagrams take all the guesswork out of making the doors functional. I chose to use the suggested Spring Air* retracts along with Robart* Oleo struts; this combination was both strong and reliable.

After all moving parts of the nacelles have been tested for smooth operation, it's time to attach the nacelles to the wing. Be quite sober about this step, and make sure you get the the nacelles positioned properly. Check and re-check before the epoxy goes on.

FUSELAGE CONSTRUCTION

The fuselage is built upside-down over the plans. The marked plywood formers fit into place very well. The stringers fit snugly in their respective slots and provide a nice smooth surface for the 1/8-inch balsa skin. Using a water and ammonia solution helps to bend the balsa around the curved areas. The instructions and plans show the use of fiberglass cloth and epoxy in front of the wing cutout. Don't skimp here, as its use greatly strengthens the fuselage. Being able to remove the cockpit area allows you to access the radio gear when the plane is assembled, so you can make fine adjustments and access the batteries. I also installed a glow-plug system. All major construction is now completed.

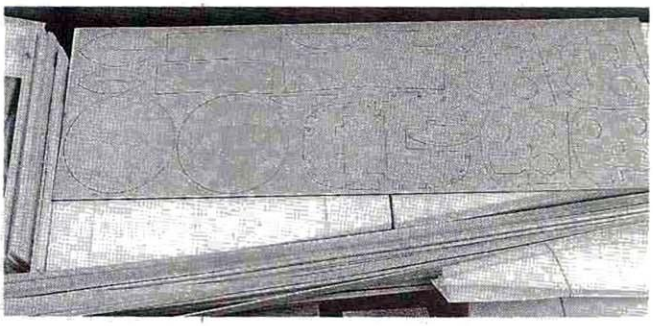


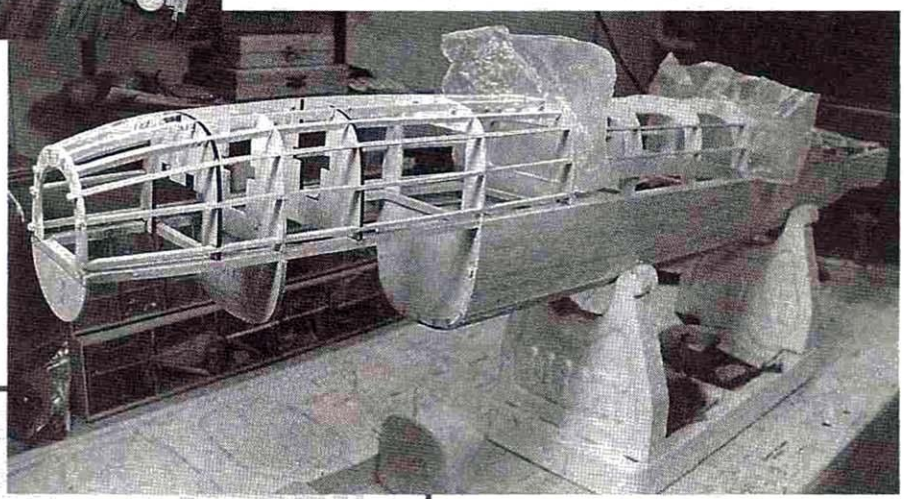
The vertical fins are built up and sheeted with balsa.

It is time to sand, sand and sand to get that glasslike finish on the balsa. The foundation must be flawless for the finished product to look good. The final step is to cover the entire plane with 3/4-ounce glass. I used the Aerospace Composite Products* system for this. The first step is to spray the area with 3M adhesive, let it set, then lay the glass over the surface. A second pair of hands helps quite a bit. The glass can then be spread easily with no wrinkles. The Aerospace product is an epoxy diluted 50 percent with isopropyl alcohol and brushed on. This worked great, set up quickly and is very light when dry. You can prime the next day.

I masked the canopy and blister areas with liquid mask film before priming. I used F&M Enterprises* Feather Coat primer to fill the glass weave, sanded it lightly and shot the primer a second time. I painted the B-25 with F&M Enterprises Polytone paint; I just poured it out of the can and into my gun—no two-part mixing or thinning out. I shot the plane, and a few moments later, it all set up. There were only three runs over the entire plane, so I just sanded them down and retouched those areas. I was really pleased with the results.

The B-25's laser-cut aircraft plywood and die-cut plywood parts fit together nicely.





The fuselage is built upside-down over the plans. The marked plywood formers fit into place very well. The stringers fit snugly in their respective slots and provide a nice smooth surface for the 1/8-inch balsa skin.

The vacuum-formed engine cowls also worked out nicely. They fit together well and are easy to attach and to remove. I applied fiberglass cloth to the inside of the cowls to strengthen them as suggested in the manual.

Now install the radio equipment and see how the surfaces function. It was a pleasure to install the equipment in such a large fuselage, and it was easy to balance the plane because there's a large latitude in which to play with the two battery packs. (Yes, two battery packs—one for the servos and the

SPECIFICATIONS

Name: North American B-25

Manufacturer: Wing Mfg.

Type: scale WW II bomber

Wingspan: 84 in.

Wing area: 920 sq. in.

Length: 64 in.

Weight: 20 lb.

Wing loading: 50 oz./sq.ft.

Engines req'd: 2 .40 to .60 2-strokes or .48 to .90 4-strokes

Engines used: O.S. 91s

List price: $499.99

Features: laser-cut aircraft plywood and die-cut plywood parts; clear plastic canopy, nose section and turret and side gun windows; formed top nacelle fairings, gun blisters, intake scoops and exhaust ports; full color decal sheet with squadron art and kill markings; foam-core wings and stab; hardware package; step-by-step instruction manual; full-size plans.

Comments: the kit includes all necessary nuts, bolts and screws. The many ABS formed-plastic parts speed construction, and the full-size plans supply a wealth of construction information. The B-25 requires an experienced builder and flyer, however. If you meet this requirement, you're in for a great project.

Hits

- Laser-cut plywood for nacelles was excellent.
- Gear for mechanics very helpful setting up gear door operations.
- Straightforward construction manual.
- Detailed, full-size plans.

Misses

- Joining the canopy pieces so the seam is less visible is tedious.
- Rudder control was difficult to set up and, after it has been assembled, you can't get at it because it's inside the tail of the fuselage.

FLIGHT PERFORMANCE

To test-fly the B-25, we went to a private grass-strip airport. I'm pleased to say that the first flight went off without a hitch. The B-25 probably lands and takes off at around 35mph, and top speed is approximately 100mph.

• Takeoff and landing

During the takeoff run, the B-25 was left on the ground for a little longer than I would leave most planes, but with the size and complexity of this model, speed was kept up on purpose by holding a slight amount of down-elevator. With only a hint of elevator backpressure, the bomber rotated very naturally and assumed a smooth flight posture as it lifted off. It was off the ground in short order, and I raised the landing gear to further increase airspeed. It accelerated to a speed that I would have not thought possible for such a big model.

The twin O.S. .91s turning 3-blade 12x8 props were working overtime! Within 10 seconds I throttled back to stop the model from climbing out of sight. The only trim changes needed were a little down-elevator and some right rudder; I attribute this to the abundance of power.

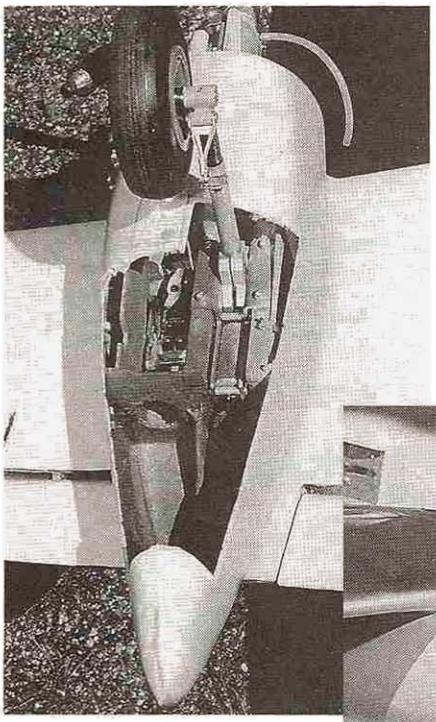
With the landing gear down, there seems to be enough drag for two planes. Once the throttle is reduced, care must be taken to prevent the airspeed from deteriorating; keep the nose down. If you don't lower the nose, you may find that the model sinks too quickly, leaving you hoping that both engines come up on power at the same rate. The smartest approach is to maintain ¼ throttle until you've reached the field and then slowly reduce power until touchdown. Once on the ground, cut power all the way to idle to bleed airspeed off at a controlled rate and keep air flowing over the elevator for full flare.

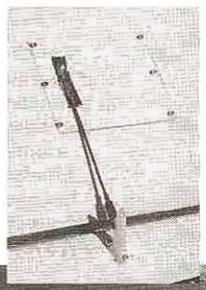
• Low-speed performance

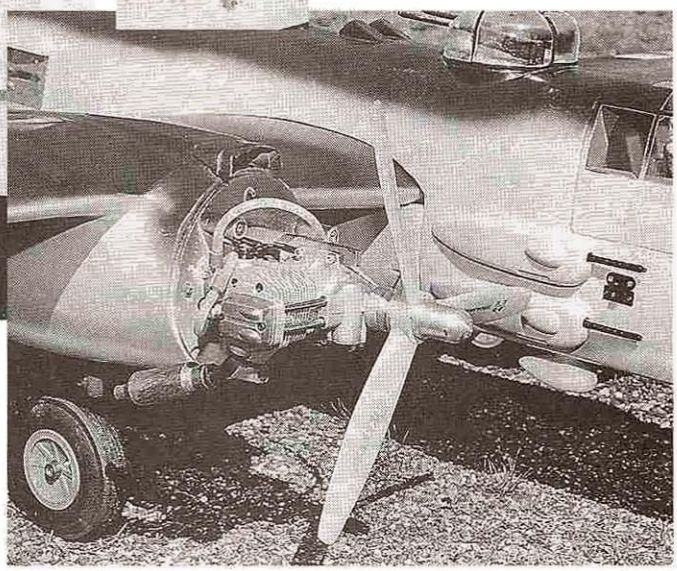
The model weighed in at 20 pounds yet stalled very gently, with only a hint of a break to the left. When landing and taking off, I strongly recommend the use of flaps, as it offers the pilot an added degree of stability from the induced washout. Throughout the stall, the bomber stays fairly responsive. The ailerons began to feel a little mushy. But as the nose is lowered, the ailerons regained their solid feel.

• High-speed performance

Are you kidding? With this much power, I was unable to induce a high-speed stall. To do so would have required G-loadings that would probably have folded the wings (and these wings are very strong). No changes were noted in control sensitivity from dead slow through full-power throttle settings. This included extension and retraction of the landing gear.







Clockwise from above: the Robart struts mounted on Spring Air retracts operate smoothly. The aileron servo is positioned in the wing panel, where it can be easily accessed through the servo hatch. An O.S. .91 turning a 3-blade 12x8 prop on each side of the B-25 provides plenty of power.

other for the McDaniel* onboard glow system. You don't want to lose an engine on an approach; if you do, you buy the farm.) There are 12 servos in the craft, and wires and hoses are all over the place. I sorted, labeled and wrapped them with nylon clips to make assembly and disconnecting simple.

The kit decals adhered well to the paint. You can buy Wing Mfg. machine guns that dress up the canopies, turret and blisters with nice detail. The plane was now ready for a trial taxi run. I removed the cowls so I'd be able to adjust the engines. The two well-broken-in O.S.* .91 4-strokes started right up and needed little adjustment. The 3-blade 12x8 Graupner* props really bit the air. At ½ throttle, the plane wanted to leap off the ground. The Robart strut suspension system adjusted well to the grass runway. I taxied two tanks of fuel and really had the urge to get the bird into the air. There's nothing like the sound of a twin-engine plane!

CONCLUSION

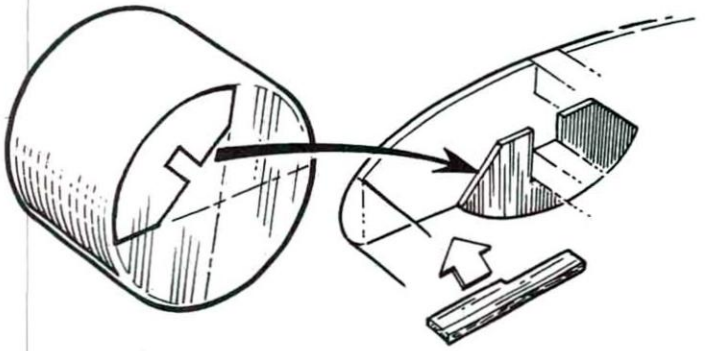
This airplane is spectacular. It is a showstopper on the ground, but in the air, it takes your breath away. The twin 4-strokes growl like radials, and the B-25's speed and rock-solid flight performance mesmerize onlookers. The Wing Mfg. B-25 requires experience with large models as well as good multi-engine setup skills. If you have this experience, you're in for a real treat.

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*

Hints & KINKS

by JIM NEWMAN

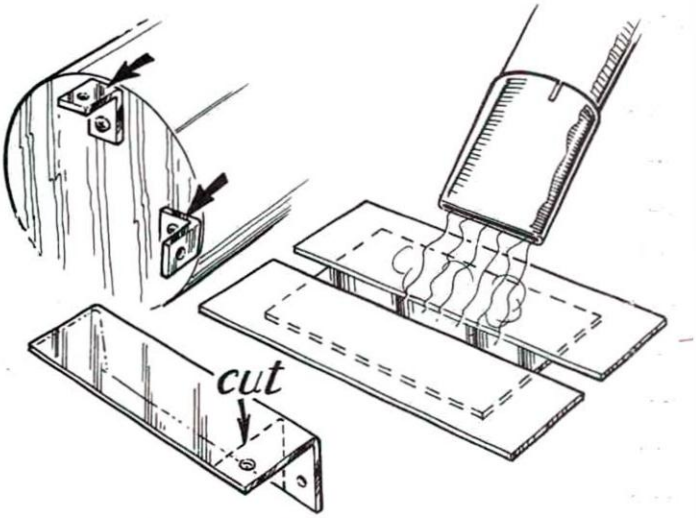
Model Airplane News will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



TIP SAVER

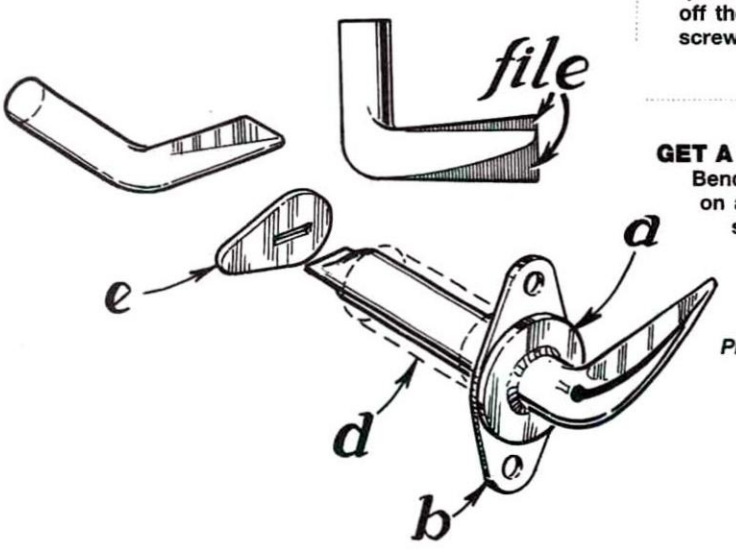
You can cut four of these wingtip skids from the plastic caps on spray cans. Glue a skid to the face of each tip rib, as shown, then add a strip of balsa on which to attach the covering.

Victor Hamdan, Tartagal, Argentina



NON-STRIP BRACKETS

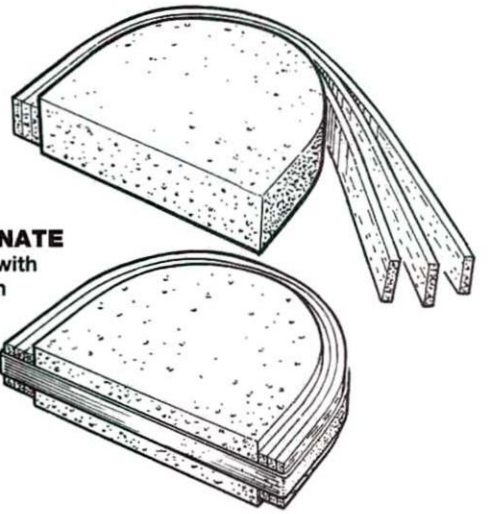
Lexan is very tough and tolerates frequent screw removal very well. Using two strips of plywood as shields, blast the exposed strip with a heat gun and quickly bend the strip over the edge of a bench. Cut off the brackets as required, then drill holes for the screws. ***Dagley Reeves, Fountain Hills, AZ***



GET A HANDLE ON IT

Bend, flatten and file brass tube as shown. Solder on a washer (a), coating both parts with solder to simulate chrome. Cut a fascia plate (b) out of aluminum litho plate, slip on an aluminum bearing tube (d), then solder on a latch tab (e) to complete this scale columnist's Fairchild- or Moth-type latch.

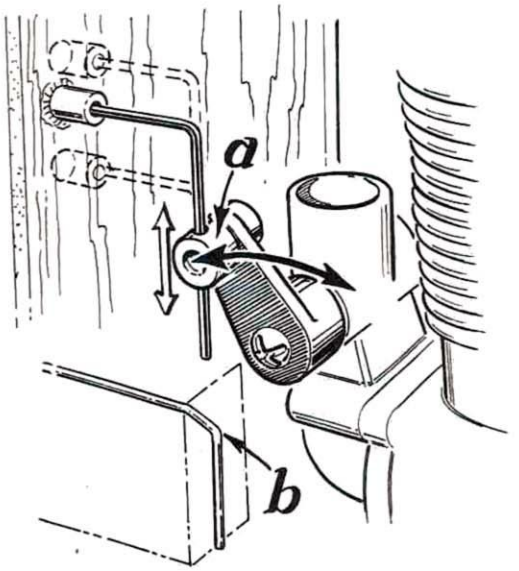
Philip Kent, Cleckheaton, Yorkshire, England



UNCOMPLICATE WITH LAMINATE

Cut a mold of thick insulating foam, soak balsa or basswood strips with 50:50 ammonia and water (or spray them with glass cleaner), then rubber band them around the form until they're dry. Next, coat each strip with carpenter's glue, then rubber band the strips around the form again. No joints to fit, and this method is strong and simple.

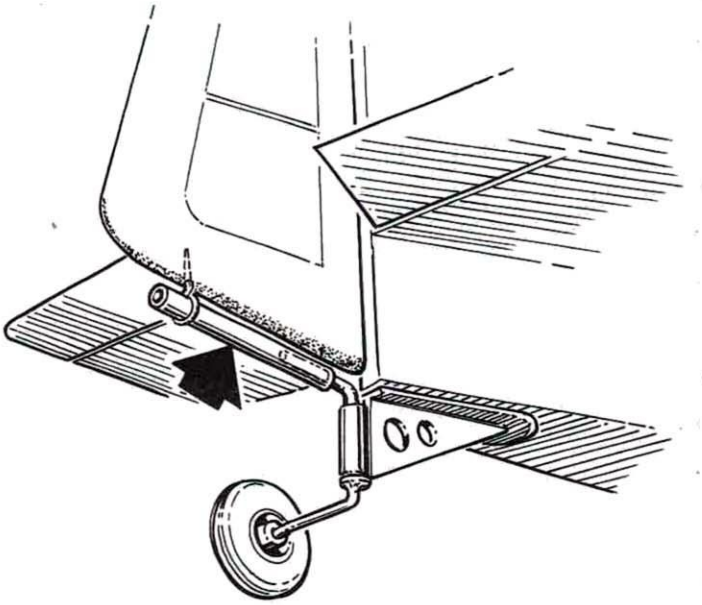
Gene Chase, Oshkosh, WI



SLIP JOINT

Good where a 4-stroke carburetor must be mounted close to the firewall. The throttle pushrod is 1/16-inch (1.5mm) wire; it's not critical where it exits the firewall. The rotating bushing (a) is an EZ connector minus the clamping screw. As the arm rotates, the bushing slides smoothly up and down the wire. A second bend (b) can be made for better alignment if required.

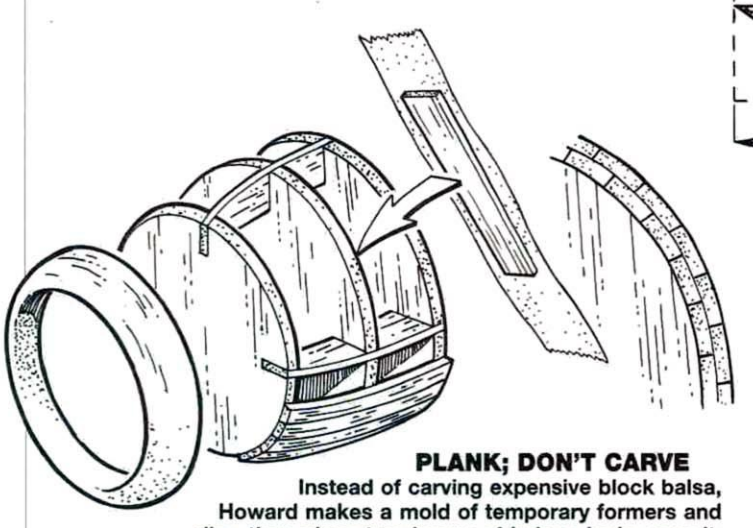
William Strebbing, Howell, MI



STOP THE SHOCK

Connect the rudder and tailwheel wire with a piece of flexible inner Nyrod that slides through a screw eye in the rudder bottom. The Nyrod will flex and minimize the kickback shocks to the servo gears.

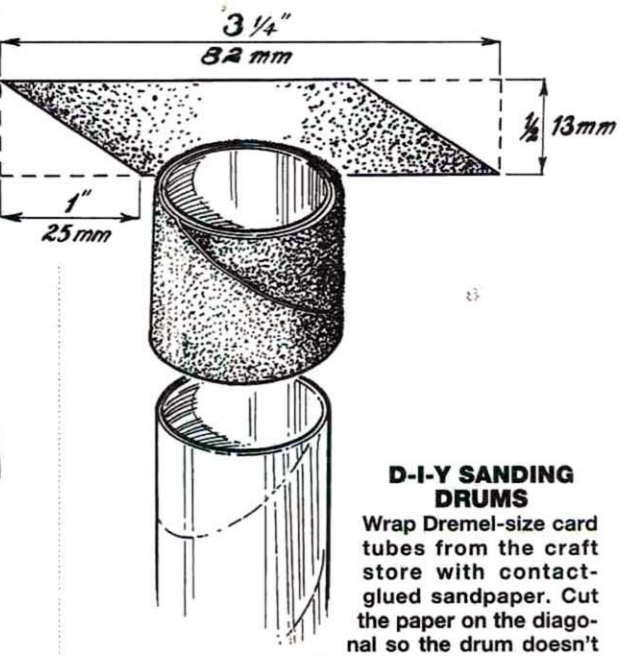
William Magner, San Jose, CA



PLANK; DON'T CARVE

Instead of carving expensive block balsa, Howard makes a mold of temporary formers and ribs, then glues two layers of balsa planks over it, with the joints staggered. To prevent the planks from snapping, he snugs them down with masking tape. You could also soak the planks with glass cleaner before application. The mold can be made of foam board instead of balsa because it's knocked out upon completion.

Howard Sullivan, Arab, AL



D-I-Y SANDING DRUMS

Wrap Dremel-size card tubes from the craft store with contact-glued sandpaper. Cut the paper on the diagonal so the drum doesn't "bump" as it turns. Secure the points with a little CA.

Robert Calisi, Toronto, Ontario, Canada

Mike Barbee's B-29

by LARRY MARSHALL

PHOTOS BY WALTER SIDAS

In 1938, Gen. Westover proposed the need for a high-altitude strategic bomber to replace the B-17. The idea was not received well by many who felt the project too expensive and unnecessary. Little did those debating the issue know what lay in store. But less than a year after the Japanese bombed

Pearl Harbor, the XB-29 prototype made its first flight in September of 1942.

At the time, the Boeing B-29 Superfortress was at the cutting edge of aviation development. It was the first pressurized bomber, having two compartments pressurized as well as a long crawl tube that connected the two areas. It was the world's heaviest production airplane and had a higher wing loading than any other aircraft. It carried a crew of 11—six in the front section and five in the rearward pressurized section. These crews and their planes were crucial to the ending of WW II, as they made incendiary raids on Japanese cities and ultimately dropped atomic bombs on Hiroshima and Nagasaki.

Mike Barbee's model of the B-29 is a tribute not only to this rich history but also to his father, who flew B-29s. Mike modeled this particular aircraft after the B-29 on display at the Pima Air Museum. It was part of the 330th Bomb Group, where it was dubbed "Sentimental Journey." The right side of the aircraft carries the 314th Wing name of "Quaker City." Mike scratch-built the model using Don Smith* plans. He got the great aluminum finish using Coverite* Presto panels. It weighs 43 pounds, has a 141-inch wingspan and is powered by four Saito* .91 4-stroke engines. He flies the plane using a Futaba* 9ZAP radio and 22 servos.

Mike is a serious scale competitor and flew his B-29 at Top Gun. Nevertheless, he has quite a sense of humor, as evidenced by the graffiti on the six bombs he drops as one of his maneuvers. They say things like, "This is for Hahn, then he'll be gone," "Sooooo long, Foley," and "You'll need a lot of Zap to put things back together after this one." For those unfamiliar with their names, Jeff Foley and Greg Hahn are a couple of Mike's fellow Top Gun competitors, and Zap is a major sponsor of the event.

*Addresses are listed alphabetically in the Index of Manufacturers on page 182.

Mike Barbee tachs his engines just prior to flight.

SPECIFICATIONS

Name: B-29 Superfortress

Type: WW II heavy bomber

Wingspan: 141 in.

Weight: 43 lb.

Engines: Saito .91 (4)

Radio: Futaba 9ZAP w/22 servos

Covering: Coverite Presto

Construction: balsa, plywood and spruce

Comments: Mike's B-29 was scratch-built from Don Smith plans. Mike flew it in competition for the first time at the 1997 Top Gun scale invitational.

Lighter-than-Air R/C

Designing and building blimps

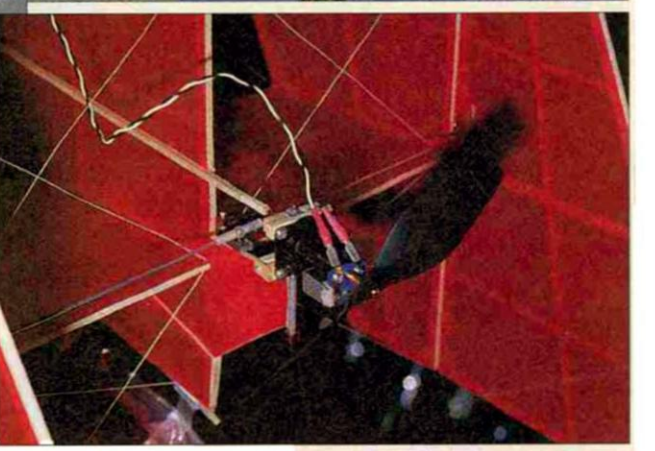
PHOTOS BY TONY AVAK & JOE GHEBRIT

Right: Mike Dodd's 2-channel Gold blimp uses motors and electronics from S.G. Corp. Twin-turbo fan system. The model uses differential thrust for turning and is very fast in forward flight but has limited up/down control. The ship is 6 feet long and weighs 6 ounces without helium.

The author's semi-rigid Red-Eye blimp. Note the Supercircuits video camera on the nose that transmits an image back to a TV monitor on the ground. The motor is located between tailplanes to minimize vibration up front. The bag on the Red-Eye is made of four gores of metalized nylon turned inside-out. The ship is 9 feet long and weighs 30 ounces without helium.

by TONY AVAK

I'VE FLOWN R/C model blimps at hobby shows and indoor model airplane meets around the country for many years. Public reaction to my lighter-than-air (LTA) craft has always been positive and, because of the rarity of these models, there are always a lot of questions about them. This article will answer many of those questions and will provide enough basic information for you to design and build an R/C blimp. Refer to my article in the July '97 issue of Model Airplane News for other LTA designs, kit information and additional sources of material.



Close-up of the motor mount on the author's Red-Eye blimp. The motor can pitch and turn for full vectored thrust control.

Above: close-up of the motor mount on Mike Dodd's Ornithopter blimp. Note the hinge over the motor that allows the mechanism to pitch up and down for vectored thrust control. The rudder can also be pulsed back and forth for additional thrust. The motor and the mechanism come from a Mattel Sectoid toy.

Right: one of Mike Dodd's Ornithopter blimps. The model is 7½ feet long and weighs 15 ounces without helium.

Without a doubt, blimps are the easiest model aircraft to control in the air. Their slow speed and easy handling characteristics make them the most relaxing and enjoyable flying experience there is; I've had kids under 10 years old doing precision spot landings within 5 minutes of taking the transmitter.

These models should be considered for indoor use only. Unless your LTA model can do at least 15mph in still air, a thermal can carry it away—even on a windless day.

Most LTA craft use 3 channels for control: rudder, elevator and throttle. You can substitute motors vectoring thrust in different directions for rudder and/or elevator, but you'll still need a minimum of 3 channels for full control. Two channels are fine if you're happy with a constant throttle setting, and I have a single-channel rubber-band-powered blimp that can easily do 15-minute flights. It's ballasted slightly heavy, so it goes up under power and comes back as the rubber winds down.

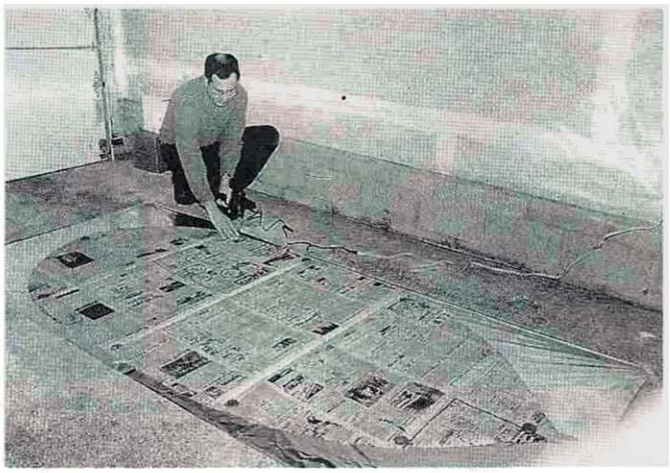
Method no. 1: using a soldering tool to cut out and heat-seal together two layers of plastic.

You can fly a blimp with any radio, but there's no need to waste helium; use the smallest, lightest servos and receiver batteries that will do the job. For my fully proportional needs, I prefer the super-light systems from Cannon R/C Systems*. Their 3-channel/3-servo Micro-Elite system with 50mAh receiver Ni-Cds weighs only 2.24 ounces.

LIFTING GAS

In all instances, you should fill your blimp with helium. Hydrogen is explosive when mixed with even small amounts of oxygen and can be ignited by a spark of static electricity or a cigarette flame. On the other hand, helium is chemically inert and perfectly harmless.

Helium is available at any party-supply store or welding-supply shop. (I'd get it from the latter, as that's where the party stores get it from, too.) Rent a small tank; purchase one later if you decide to really get into it. When the tank is empty, take it back to the shop and trade it in for another tank of the same size. You pay only for the cost of the helium. You can expect to pay about 25 cents per cubic foot. Nine-cubic-foot tanks are sometimes available from stores like Kmart or Wal-Mart for $20, but these tanks aren't refillable.



Plastic stretched over a garage floor, with the pattern on top.

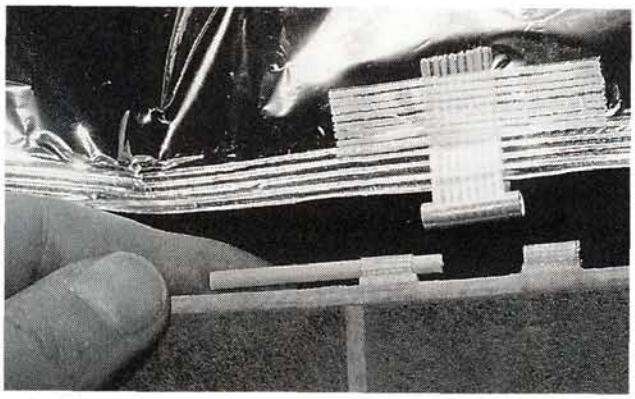
As a good rule of thumb, 1 cubic foot of helium will lift 1 ounce. That doesn't include the weight of the balloon or bag that holds the helium, and the amount will be much less in high-altitude locations like Denver, CO.

BAG MATERIALS

Bags can be made of any light, gas-tight plastic, like dry-cleaning bags, trash bags, plastic drop cloths and other forms of polyethylene. Thicker polyethylene holds helium better but is proportionally heavier. Look for 1.5-mil (thousandths of an inch) thickness or less for blimps under 8 feet in length. Du Pont Mylar® plastic is more difficult to work with, but it's stronger and holds helium much better. Look for it at a local plastics distributor. If weight is critical on your project, I have some 0.5-mil aluminized Mylar for sale for $.50 per foot (48 inches wide, $10 minimum), plus $7 for UPS. (Send an SASE to me at 21640 Atalanta St., Lexington Park, MD 20653 for a free sample.) Metalized, 1.5-mil nylon—the same stuff silver party balloons are made of—is heavier than the 0.5-mil Mylar, very strong and flexible and comes with a heat-sensitive adhesive on the back that's easy to work with. West Coast Blimps and Electronics* sells it for $1 per foot (38 inches wide).

To figure out how big a model blimp's bag needs to be, first estimate the total weight of all the hardware, including the bag; then remember that 1 cubic foot lifts 1 ounce of weight. For conventionally shaped airships, I use this formula: volume = $\frac{1}{2}$ diameter^2 x length. That's the upper limit of volume you can expect. For safety, I always multiply that amount by 0.8 and design my ship around this lower limit. Any extra lift I might have I use for more batteries or ballast. The ideal ratio between length and diameter for a blimp (the "fineness" ratio) is between 3.4 and 4.0. Any lower than that and bag aerodynamics become increasingly unstable in forward flight. Blimps have been built with much higher fineness ratios for better streamlining and speed, but this compromises maneuverability in small spaces.

Method no. 2: ironing HeatnBond around the pattern.



Left: the soda-straw fill valve of a typical bag. Note the serrated-jaw crimping pattern from a Futura heat-sealer. Right: one method of attaching the bag to the keel. A 1/8-inch-diameter dowel is slid into place to hold the tube, which is taped to the bag.

DESIGN AND CONSTRUCTION

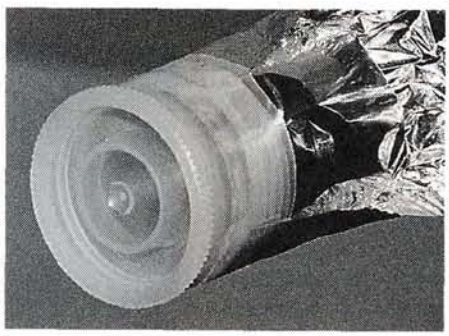
There are three basic ways of making a bag. The first—ideal for most plastics—is quick, easy and lightweight, but the seam is thin, and leaks can be difficult to find. The other ways, for Mylar and metalized-nylon bags only (due to higher melting points of those plastics) are more work, but give a superior bag that can hold helium for days or weeks. All methods described here make bags of two "gores" (the individual pieces joined to make a single bag).

Start with a full-size paper pattern (I use newspaper). Remember, you'll be making a 3D bag from 2D plastic, so the paper-pattern diameter will have to be 1.57 ($\pi/2$) greater than the ultimate inflated-bag diameter. The inflated bag will be a little shorter, too, but its length won't decrease as much as its width. I find it best to design the bag using a series of short, straight lines that are each at least 3 inches long. This also creates a more wrinkle-free bag. Don't forget to include a place to insert the filler and dump valves!

• **Plastics.** Spread two layers of plastic over a smooth concrete floor (like that of a garage), taping the corners back to yield a tight surface. (Sweep and damp-mop the floor before to prevent sand or grit from wearing into the plastic.) Important: if you use aluminized Mylar or metalized nylon, keep the shiny side (metalized side) on the outside; otherwise, the seams won't hold. Place the paper pattern on top, and hold it down with several small weights. Next, hold a short, straight stick on the inside edge of the pattern, and use it to press the two layers of plastic together. Draw a hot soldering gun along the edge of the stick. This heat-seals the seams and cuts out the bag at the same time. I use a 230W Sears Craftsman soldering gun with a linoleum-cutting tip. A tip glowing near infrared is best for the plastic, though lower temperatures can be used for polyethylene. Experiment to find the ideal seaming speed for your tool/plastic combination. If it's too fast, the plastic edges won't meld together; too slow, and you'll set your project on fire. Be sure to overlap the edges of the seams as you work around the pattern. With practice, the entire process, including preparation and cleanup time, should take less than an hour.

When you're done, carefully peel the bag from the floor, tape the filler and dump valves in place, and test-inflate the bag with dry air from a small compressor or hair dryer. Don't inflate with your lungs, as moisture from your breath will condense inside, making a wet, heavy bag. And don't over-inflate! The seam is very thin and can easily burst. Check for leaks by standing the inflated bag on end and waiting a few minutes. Even a small (1/16-inch-diameter) leak will shortly become evident. To find the leak, hold your mouth over the suspected area with the bag under a very slight pressure. You'll be able to feel even a light airflow on your lips. Patch any holes with Scotch tape. That's it!

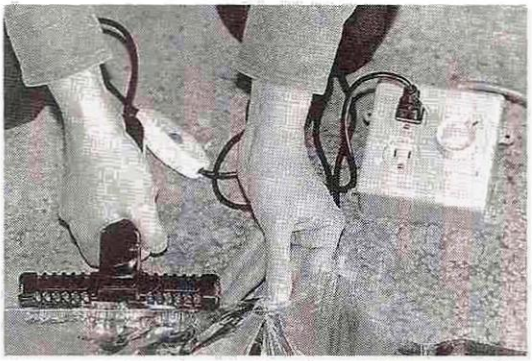
A dump valve made of a metalized-nylon plastic "tube" turned inside-out and ironed into the seam. The end of the tube is taped over to seal.



A dump valve made from 35mm film canister, taped to the tail end of the bag.

• **Mylar.** This method can be performed on wood or linoleum surfaces as well as concrete. Stretch just one layer of plastic on the floor as before, and hold the pattern in place with small weights. With a hobby iron set at 250° F, tack down a strip of 3/8-inch-wide Therm O Web Original HeatnBond or HeatnBond Ultrahold around the pattern. This material is used to bond together cloth without sewing and is available at fabric stores. When that is done, remove the pattern and the paper backing of the HeatnBond, and stretch the second layer of plastic on top by taping the corners. Now, here's the tricky part: increase the temperature to 275° F, and iron the two layers of plastic together. You'll have to "feel" the location of the HeatnBond strip through the plastic; this takes some practice to perfect. Carefully cut the excess plastic away using a new hobby blade, flip the bag over, and iron the edge from the other side. Make the iron as hot as possible to melt the HeatnBond adhesive, but not so much that it melts the bag plastic. This last step is important to ensure adhesion. For extra good seams, you can purchase a hand-operated Futura portable heat-sealer with serrated jaws (CELLO model) for about $140 from Packaging Aids Corp.* for the last step. Plugged into a voltage regulator for temperature control, it presses the plastic layers together for a super-strong seam so the bags can be inflated to much higher pressures. Finish as above.

• **Metalized nylon only.** The layers of plastic are ironed directly together rather than heat-sealed, since the nylon already has a heat-sensitive adhesive on the back. Simply iron around a pattern (guided by a stick as before) set on two layers of plastic—adhesive-side in; then cut away the excess. Or, cut the plastic out first about 1/4 to 1/2 inch larger than the pattern, and then iron around



A Futura portable heat-sealer crimping the seam of the bag. Note the homemade voltage regulator used to control the heat output of the tool.

the edge. The Futura heat-sealer can be used for extra security.

Using variations of the second or third methods, you can cover the frame of a rigid airship model or make multiple-gore bags for a cleaner, more wrinkle-free blimp bag. Leaving 1 foot of seam open for sealing last, blimp bags made by this method can be turned inside-out to completely hide the seams on the inside.

FILL VALVES

The fill valve I've used on all my blimps is nothing more than a soda straw with clay plugged in one end. The straw is inserted through the seam on the bottom of the bag and held in place with a gas-tight application of Scotch tape. For bags over 5 cubic feet, I also include a larger dump valve that can be unplugged to rapidly release the helium. My favorite dump valve is a 35mm film canister with its bottom cut off and taped to the tail end of the bag. Just pop the cap to open it. The "valves" on John Piri's blimps are even simpler. He just leaves a squared-off edge of plastic on the bag that he tapes over to seal. For bags made of metalized nylon, you can make a short "tube" of the material, turn it inside-out so the adhesive is on the outside, then iron it into the seam for the fill and dump valves. This method works well for bags that will be turned inside-out.

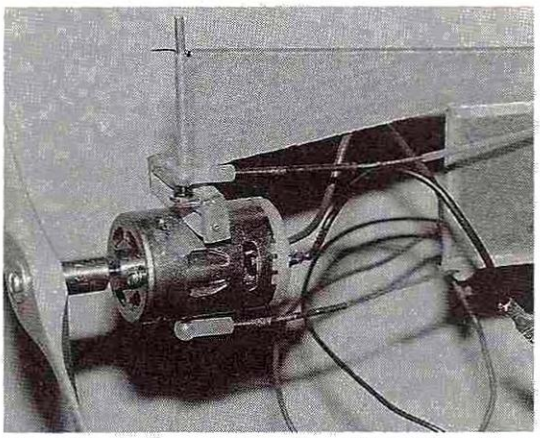
I can detach the bag from the keel on all of my models. This allows easy transportation of the model and exchange of different bags on the same keel—like putting new wings on the same airplane fuselage. There are any number of effective ways of doing it, but all of them involve Scotch tape. If you want to shift the keel fore and aft along the bag to balance the CG, suspend the keel from the bag by strong thread that's looped around the keel and that can be repositioned as necessary.

Use Scotch tape to repair any leaks. One evening, I left my blimp inflated overnight in the back room of a show. The next morning, I found that someone had gone in and caused an 18-inch-long tear in the bag. I deflated the bag, taped it up and flew for another two days—no problem.

MISCELLANEOUS INFORMATION

Model blimps can get along on surprisingly small motors at very low voltages; it just depends on what top end speed you're happy with. Anything that can swing a prop can move a blimp in still air. Most indoor LTA models do quite well at a quick walking pace of 3 to 4mph max, but if you plan to fly them outside, you should be able to do a minimum of 15mph to fly against light breezes and thermals. The ability to go in reverse is important to enhance indoor maneuverability, but it's not essential.

To balance the model in the air, simply inflate the bag with helium until the model starts to float away: then put in enough ballast to make it hang in the air in front of you. (I reserve 5 to 10 percent of the total weight of a model for ballast.) I use BBs for ballast; it takes only two or three to fine-tune the buoyancy, even on a large model. It helps to locate the ballast box under the center of lift of the bag so the CG doesn't shift when you add or subtract weight; this might cause the ship to pitch up or down. For all LTA craft, the CG is located directly under the center of volume/center of lift of the bag to make the ship float level.



One method of mounting a motor to allow both up/down and left/right movement for vectored thrust control of LTA craft.

Blimps fly best ballasted neutral in the air, but for safety, I trim mine just a little heavy so it will come back down if something happens in flight and I lose up/down control. If the bag has a known, steady leak, you can increase flight time by launching it light and landing it heavy.

When an LTA craft is ballasted to just float in the air, up/down control is easily accomplished by using the horizontal stabs, by vectoring the thrust of the motor(s), or both. At low or no airspeed, conventional control surfaces have no effect. "Vectored thrust," the ability to maneuver a model around by pointing the motor thrust in different directions, is therefore an obvious benefit and is used on both full-scale as well as model LTA craft. The technique you use to gimbal your motor will depend on your specific design needs.

The preferred location of the motor(s) depends on the design. I put the motors at the front of my semi-rigid ships to help balance out the weight of the tail in back and for greater leverage to turn the ship with vectored thrust. The middle is best if you use differential thrust of two motors to steer, provided that the motors are a reasonable distance apart. A motor in back is theoretically the best aerodynamically (no fuselage to get in the way of thrust), but a tractor design may exhibit different handling characteristics in flight.

I've never found an indoor site where I couldn't easily fly to the ceiling. Most of my airships are semi-rigid designs, so the bags do not need to be fully pressurized to make the model fly, leaving lots of room for gas expansion. Pressurized designs flown indoors can usually withstand the fractional change in volume from altitude. Another concern is that warm air at the top of a room can cause the helium to expand, but I've never had a problem with this, either.

Model LTA can be made quite small, but the smaller the blimp, the less the performance and control you necessarily have. My smallest R/C blimp is a single-channel, rubber-band-powered, 40-inch-long craft that weighs 1.1 ounce without helium. S.G. Corp.* offers a 2-channel, 38-inch-diameter saucer blimp. My smallest 3-channel, fully proportional, battery-powered blimp is 6½ feet long and weighs just 9 ounces without helium, but it's on the edge of being underpowered.

If you have any other questions or need help in getting started, please feel free to contact me. Also, if you do build an LTA craft, radio-controlled or free-flight, kit or scratch-built, please send me a photograph and information about it.

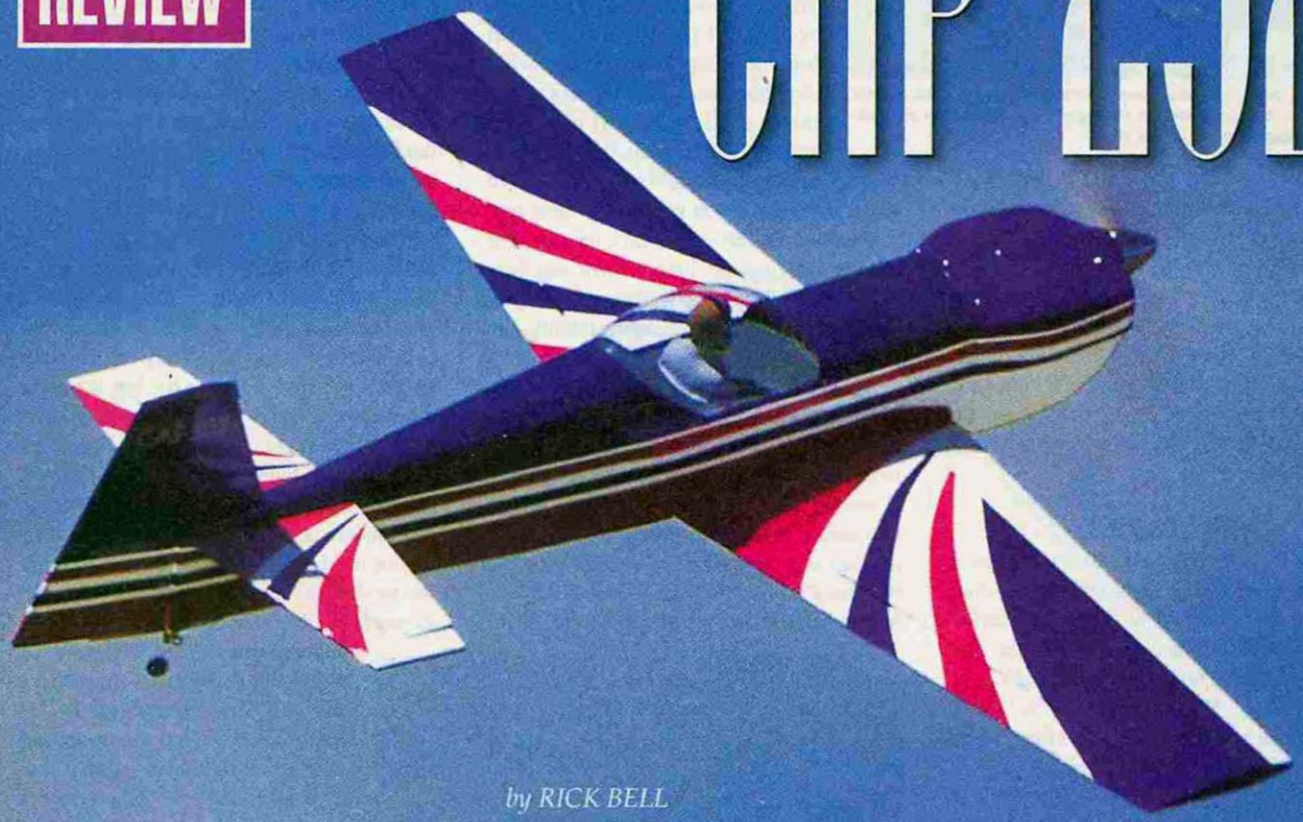
**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

Midwest Products Inc.

CAP 232



by RICK BELL

AVIONS MUDRY (of France), which produce the successful CAP series of aerobatic aircraft, began life in 1953 as "Cooperatives des Ateliers Aeronautiques de la Region Parisienne" (*whew!*). The name was changed to Avions Mudry in 1968. In 1994, the French stole the World Aerobatic Championships with the CAP 231EX, which had a CAP 231 fuselage and an Extra 300S wing. Needless to say, Walter Extra doesn't sell wings anymore, so Avions Mudry refined the 231EX design into the "Extra"-ordinary CAP 232. Midwest Products Inc.* has done the same by using their Extra 300S wing as the basis for their newest IMAA- and IMAC-legal release.

C'est magnifique!

THE KIT

The kit comes with balsa sheeting, die-cut lite-ply and balsa, one-piece aluminum landing gear (with axles!), a clear canopy, huge two-piece pre-trimmed ABS cowl and wheel pants. Also included are sealed bags of miscellaneous balsa and hardwood parts, accessory hardware, a decal sheet, a construction manual and rolled plans. The plans are very easy to read, they match the construction manual and show the paint scheme full-size! The manual also has setup tips and flying techniques from designer and TOC pilot Mike McConville.

TAIL GROUP

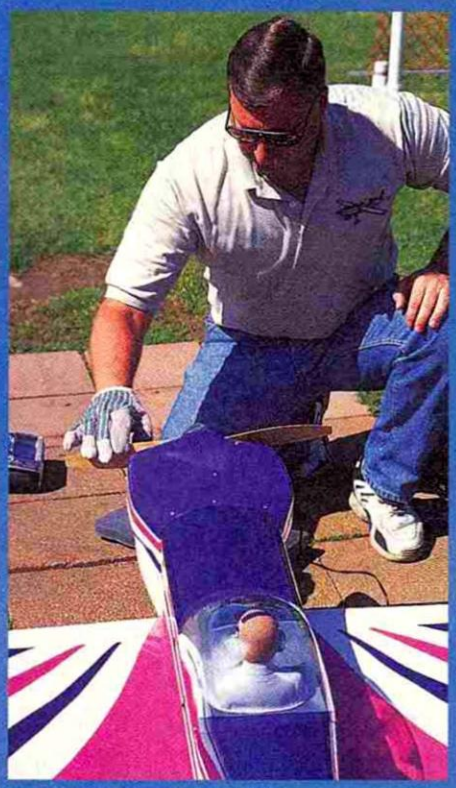
Before I began the actual construction, I made all the sheeting for the tail surfaces and the wing. Be sure to check off the steps in the manual when you've finished. All construction was accomplished using Pacer's* Zap CA and CA+. I also used Hobbypoxy* Formula II epoxy where appropriate.

The stabilizer is the first item

to be built over the plans using a 1/4x3/8-inch balsa trailing edge (TE) backed by a 1/4x3/8-inch spruce doubler (mine was badly warped and had to be replaced). The leading edge (LE) and the LE doubler are of basswood. The trusses are added and the whole assembly is then glued together. I then sanded and sheeted the stabilizer using the pre-made sheeting. The elevators are built next using 3/8-inch-square balsa sticks and some die-cut parts. Step 14 has you laminating the four elevator centers together; I waited to do this until the horn block and trussing had been installed (Step 21). I was then able to stack them one at a time for a better fit against the horn block and truss. I added anchor blocks to all surfaces for the hinges, as I used Robart's® Hinge Points. Rudder and fin construction is the same and goes quickly. I sanded all surfaces, rounded the edges and then hinged them. The manual tells you later to counterbalance the elevators using no. 4 finishing nails. I chose to do this now. Instead of using the nails (too many were needed), I glued a piece of 1/16-inch sheet in the counterbalances and used a mixture of epoxy and lead shot to balance the elevators.

FUSELAGE

The fuselage is built upside-down directly on the plans using interlocking construction techniques. I find that it's quick and easy to build a strong, straight fuselage this way. First, I glued the front and rear fuse sides together and then added the top and bottom doublers. Next, I glued the fuselage top pieces together directly on the plans top view. Be sure your work surface is flat, as this is the base for the whole fuselage assembly. I now added the formers, using a square to align them. The assembled sides are now put into place. Be sure the fuselage sides are



SPECIFICATIONS

Model: CAP 232

Type: sport-scale unlimited aerobat

Manufacturer: Midwest Products Inc.

Wingspan: 80 in.

Wing area: 1,162 sq. in.

Weight: 15 lb.

Length: 74 1/4 in.

Engine req'd: 1.5 to 2.2 2-stroke; 1.8 to 3.0 4-stroke; or 2.2 to 2.8 gas

Engine used: Moki 1.80

List price: $239.95

Features: construction manual; rolled, full-size CAD plans; die-cut balsa parts; interlocking fuselage construction; D-tube wing construction; fully symmetrical airfoil; one-piece aluminum landing gear with axles; pre-trimmed ABC cowl and wheel pants; canopy; hardware package; decal sheet; patterns for box art paint scheme.

Comments: this a very easy and quick to build unlimited aerobatic aircraft; great for IMAC events or for showing off at your local club field. It's easy to fly, performs aerobatics with ease and is even easier to land. It's an excellent choice for your first giant-scale aircraft.

Hits

- Easy-to-follow, detailed construction manual.
- Easy to build.
- High-quality wood.
- Fabulous flight performance.

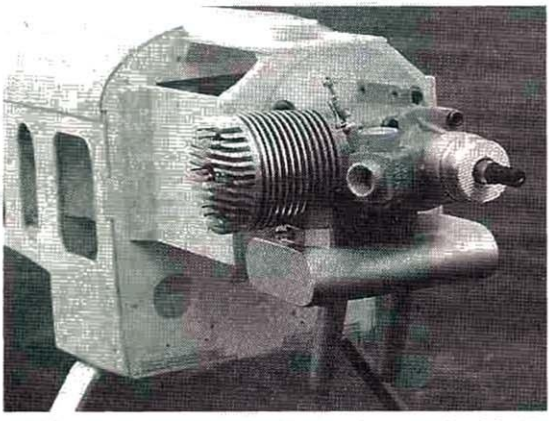
Misses

- One piece of spruce was warped.

PHOTOS BY GERRY YARROW

completely pushed down onto the top assembly. The fuselage sides bend at former F-5. This bend is rather sharp, and the fuse sides in this area should be soaked with hot water to ease the bending. All of this is then glued together. Longerons of 3/8x3/8-inch balsa are now glued to the sides. These really add a lot of strength to the fuselage assembly. I added former F-2 and pinned the landing-gear mounts with 1/8-inch dowels and then attached the gear using the supplied bolts and blind nuts. I laminated the firewall pieces together and set up the engine mount using the embossed markings.

I used the recommended Moki* 1.80 and radial mount and found this to be the easiest combination I have ever set up. The engine box sides are now laminated together. Note they are different lengths to build in the engine right thrust. They are now glued into the fuselage with the firewall. Triangular reinforcements are added, and the firewall is pinned to the engine box with 1/8-inch-diameter dowel. Do not omit this step. The front and rear turtle decks are now sheeted by adding the top formers and the 1/32-inch ply sheeting. Both decks should be soaked (I used an ammonia-based window cleaner) to prevent them from cracking when you wrap them around the formers. Be very accurate when gluing them down as there is very little margin for error. The rear blocks are now glued into place and shaped. I sanded the fuselage and then fitted the canopy and cowl. Because I'm not a big fan of plastic, I used a fiberglass cowl and wheel pants from Stan's Fiber Tech*. I did assemble the plastic cowl and found it easy to do. It also fit the model well. Be sure to glue in a cardboard tube to contain the elevator servo leads; there is no mention of this in the instructions.

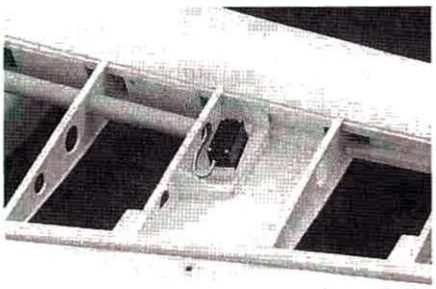


A Moki 1.80 on the nose provides ample power for this 15-pound model.

WINGING IT

The wing is of D-tube construction using spruce for the main spars and lite-ply and balsa shear webs where appropriate. The ailerons are built as part of the wing and then cut away. The wing is built upside-down directly on the plans. The tops of the ribs have jig tabs to help build a straight wing (the wing decreases in taper thickness from root to tip). I first pinned the top 3/8x3/8-inch spruce main spar in place and added the ribs using the supplied gauge to angle them. The bottom main spar is then added and glued to the ribs. Next I added the LE, the TE spars and the aileron spars to the ribs. Lite-ply shear webs are now added to the front and rear of the main spars in the center section. Be careful that epoxy does not flow into the area between the spars; this would make it very difficult to insert the dihedral brace. I added shear webs to the rest of the main spar as required and also to the rear spars. Next I added the LE and TE sheeting to the wing panel. The center section and tip sheeting are glued in place, and the aileron servo mount is added next. It is tabbed to a rib and epoxied to the main spar. I felt that more support was needed, so I added a ply gusset to the rear of the mount. The capstrips are added, as are other odds and ends. The panel is now removed and flipped over and mounted on three jig fixtures that are made of die-cut lite-ply and 1/4-inch-square balsa. Instead of pinning the jigs to the wing and the work surface as suggested, I tack-glued them in place. This gave me a stable panel to work on. The wing-mounting blocks are epoxied in place next. The other area that I felt needed to be beefed up was 3/4x3/4-inch ply aileron horn blocks. I thought they were too small for the size of the ailerons. I made new ones that went from rib to rib and deeper into the aileron. I installed a cardboard tube for the servo leads to pass through the wing, then I added the remaining sheeting and the tip block. The aileron is now cut free. The LE of the aileron and the TE of the wing are capped, sanded and hinged. The other panel is now built in the same manner. With both panels complete, I joined them using the massive 3/8x17 1/2-inch dihedral brace. When doing this, use one of the jig fixtures you used for the panel construction to align the rib centerline parallel to your work surface. Also be sure to use a slow-cure epoxy for this step.

The CAP 232 is framed up and ready for covering. The fiberglass cowl and wheel pants are from Stan's Fiber Tech; the plastic canopy is included in the kit.



The aileron servo mount is tabbed to a rib and epoxied to the main spar. I felt that more support was needed, so I added a ply gusset to the rear of the mount.

FINISHING AND COVERING

My CAP was now ready for final sanding and covering. I started with 220-grit sandpaper and worked my way down to 600-grit for that smooth base that is so important for the result. For covering I used white, Circus Pink and metallic Plum MonoKote*. I made patterns from the plans to duplicate the box art color scheme; this made a difficult task

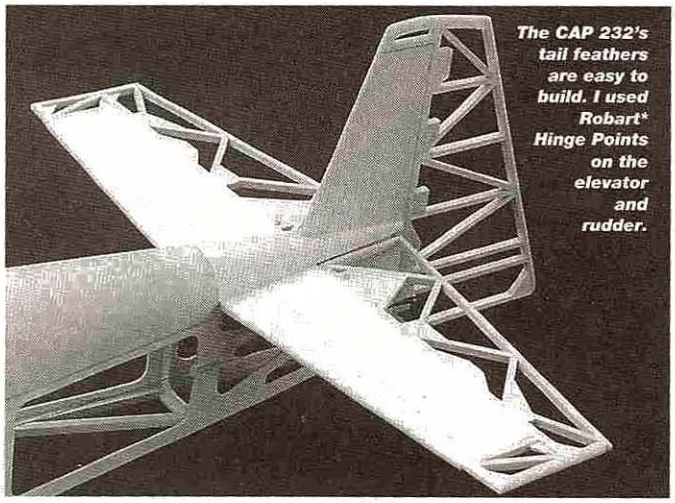
rather easy. I painted the cowl and wheel pants with matching Lustrekote*.

PUTTING IT ALL TOGETHER

The time had come to assemble all of the components, hinge the control surfaces and install the control horns. I completed the radio installation, made up the control linkages, installed a smoke system (plenty of room), mounted the motor, landing gear and wheel pants. I dressed up the cockpit area by using a Hangar 9*, 1/3-scale pilot bust, and for that final touch in the cockpit, I added a Midwest instrument panel. I also used the recommended Tru-Turn* spinner. The spinner looks great polished to a chrome finish.

PREFLIGHT

This is one of the most important steps for the success of any new model, so take your time and double-check everything. First, balance the model. For the first flights, I placed the CG about 1/2 inch forward of the recommended range (which is 5 1/2 inches from the wing LE). A small amount of lead was needed in the nose to achieve this. I set up the low and high rates of control throws per the manual and sealed all the hinge gaps and checked their movement direction. All fasteners, horns, linkages, hinges, etc., were checked again. All that was left to do was to charge the batteries and wait for favorable weather.

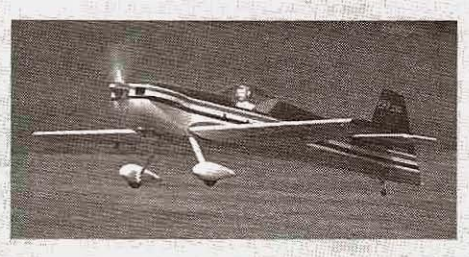


The CAP 232's tail feathers are easy to build. I used Robart* Hinge Points on the elevator and rudder.

FLIGHT PERFORMANCE

Before the first flight, I broke in the Moki 1.80 as recommended. This consisted of running it using FAI fuel as rich as it could take for 2 to 3 minutes at a time until a minimum of one hour had been recorded. I used a Zinger 18x8 propeller for break-in and flight tests. I was not disappointed with the engine performance after the break-in period; it's a powerhouse.*

• Takeoff and landing



The CAP taxies very well. No tendencies to nose over were noted. Be ready to use rudder as necessary if crosswinds are encountered; there's a lot of side area there. Takeoffs are very easy and short. Advance the throttle, hold it straight and keep slight backpressure on the elevator until moderate speed is reached. Release the backpressure and the CAP will become airborne by itself. The Moki 1.80 has plenty of power as takeoffs are made using 1/2 throttle. Once the CAP was flying, only two clicks of down-elevator and one of left rudder were needed for straight and level flight. Landings are equally easy. Just line it up on final and let it settle into its groove. The CAP is very solid and shows no tip-stalling tendencies. Hold some throttle until over the threshold. When you do cut the throttle, the CAP settles easily. A little up-elevator is all that is needed to flare for soft, three-point landings.

• Low-speed performance

The CAP can be slowed to a crawl before it stalls. When it does, the stall is gentle and forward. You get good feedback as the controls get a little mushy before the stall occurs. Low-speed aerobatics are a lot of fun and easily done.

• High-speed performance

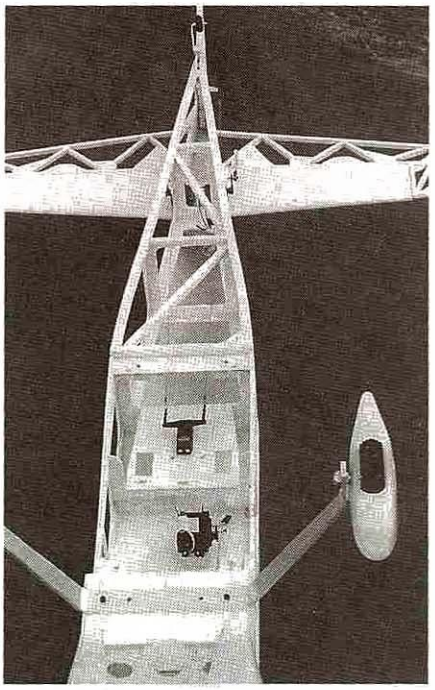
Shove the throttle to the firewall and be prepared; the CAP really moves out. No trim changes are needed between high and low speeds. The CAP grooves right along and responds nicely to control inputs. It doesn't feel like a 15-pound airplane. Starting with the recommended control throws, I found both high and low rates to be just a tad too much, so I backed them down a little.

• Aerobatics

What else is there to say? The CAP excels at aerobatics! It tracks well in looping maneuvers, both inside and outside, rolls superbly and tumbles with ease. Inverted flight requires almost no down-elevator. The CAP knifes well but does require some up-elevator to keep from tucking under. Snap maneuvers are graceful and stop quickly. As with all large-scale aircraft, throttle management is mandatory to help prevent flutter. The Midwest CAP 232 is one smooth flying aerobat that makes you look good! C'est magnifique!

FINAL THOUGHTS

I found the Midwest CAP 232 very easy and quick to build. The die-cutting was first-rate, and the wood was of above average quality for its intended use (only one piece of spruce was warped). The manual is easy to use and clarifies the many details shown on the plans. Best of all is the way the CAP flies: it's honest and begs to be wrung out. The CAP 232 is a great choice for your first giant-scale endeavor. Enjoy!



The fuselage is built upside-down directly on the plans using interlocking construction techniques.

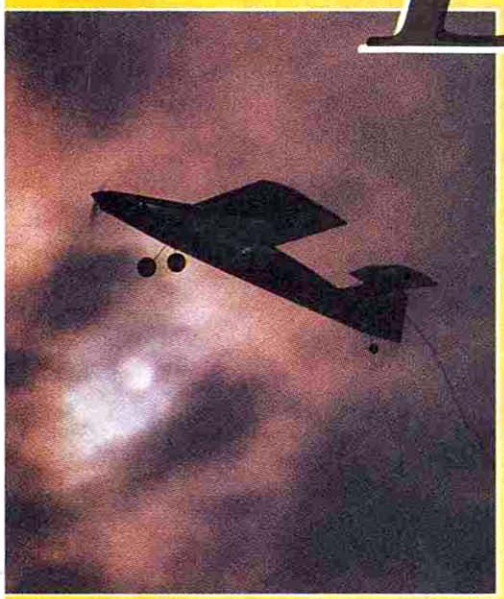
**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

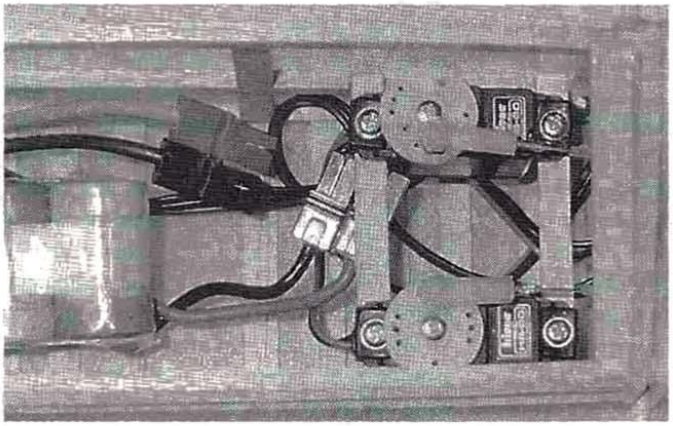
Inexpensive entry to electrics

MODELAIR-TECH *Dimwatt*



by BERNARD CAWLEY

THE DIMWATT is a member of Modelair-Tech's* "stick" series of models, most of which are intended to be powered by Speed 400 motors. These planes are built almost entirely from one size of balsa stick, including parts such as wing ribs that are normally made of sheet wood. The Dimwatt is also the smallest of a family of T-tail sport models that also includes the Megawatt and Midiwatt.



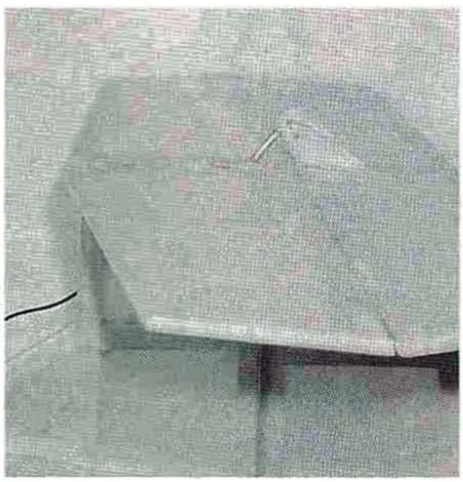
View of the servos showing the ball link for the elevator moved inward on the servo wheel to reduce control throw.

THE KIT

The kit is pretty basic, with more than enough ¼x⅛-inch balsa sticks to build the airframe; 0.078-inch-diameter wire for the main gear; 1/16-inch-thick ply for the wing joiners, control horns and landing-gear bulkhead; a neat laser-cut motor mount; wing dowels; and a plan and instructions. The wood in my kit was a good assortment; no sticks were rock-hard or punky-soft.

To finish the airframe, I bought Sullivan* no. 507 mini-cable pushrods, 1½-inch Dave Brown* treaded Lectra-Lite main wheels, material for mounting the equipment, covering and adhesives.

The plan is another one of Tom Hunt's CAD masterpieces; it shows three complete views of the airplane as well as some isometrics to clarify several details. The only problem with the plans is they're big (30x60 inches) for such a small plane. I photocopied them, then cut the views apart to build on.



PHOTOS BY BERNARD CAWLEY JR. & TRICIA CAWLEY

This extended elevator horn helps to reduce control throw.

CONSTRUCTION

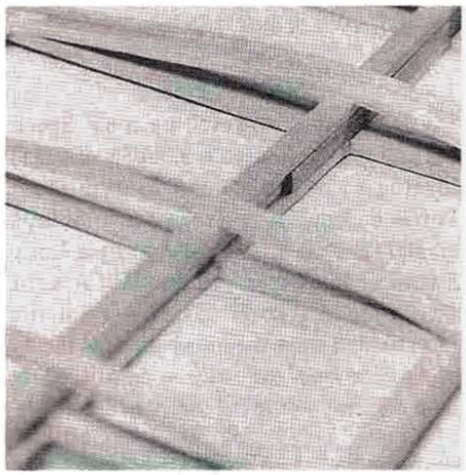
Since the airframe is made almost entirely of ¼x⅛-inch sticks, you just frame the parts over the plans. Some assemblies, such as the wing leading edge (LE) and spars and especially around the forward wing mount, are made of several sticks, but none is very time-consuming.

The only tricky part is getting the strips that form the upper contour of the wing bent smoothly from the LE, over the spar, to the trailing edge (TE). I sorted through the supplied material to find the sticks that seemed the most flexible, cut them to approximate length required and soaked them in water for quite a while. Using great care to bend them slowly and supporting them along the way, I was able to form all the ribs but one without cracking the wood (that piece became a rib top at the wing root). If I were building the plane from scratch, I think I'd use two 1/16x¼-inch strips per rib and laminate them. The instructions do note that if the rib top cracks over the spar, then just make sure that *all* the ribs do. This yields a rough triangular airfoil that I understand works well, too.

A feature of the design that had me scratching my head at first was the recommendation to leave the TEs of the tail surfaces, and even the wing, square. According to Tom Hunt, this squared-off TE has lower drag than it would have if it were rounded.

My Fourmost Products* Miter Cut and MiterMaster sander made cutting all those sticks to length and angle much easier. Both have a guide that can be adjusted for angle to the blade or sliding sanding block and are recommended to facilitate any "stick-type" construction you may be doing.

I covered the Dimwatt with Coverite* Micafilm, which is strong and light. To use it, you must apply adhesive to the airplane's structure, and Coverite recommends Balsarite for this task. However, Balsarite has a rather strong odor due to the solvent used, so for this project, I tried a British product called Balsaloc; it's



Wing construction along the spar.

SPECIFICATIONS

Name: Dimwatt

Manufacturer: Modelair-Tech

Type: S400 Sport electric

Wingspan: 34 in.

Wing area: 231 sq. in.

Length: 26 in.

Weight: 14 to 20 oz. (15.9 oz. as built w/7-cell 500AR battery)

Radio required: 3-channel (rudder, elevator, motor)

Motor required: Speed 400, direct-drive

Motor used: Robbe 400/35 (6V)

Battery used: 7-cell Sanyo 500AR or 600AE

Propeller used: Graupner 6x3 folding

List price: $24.95 (kit); $10 (plans only).

Features: all-wood construction; laser-cut motor mount; very complete plans. Clever wing mount makes battery swaps easy.

Comments: the Dimwatt is a snappy looking T-tail sport plane that packs a lot of fun in a small package. Now I see why the Speed 400 class of models has become so popular worldwide.

Hits

- Simple, fast and novel construction.
- Lively performance.
- Good flight manners.

Misses

- Nose-heavy with equipment arrangement shown on original plan.
- Elevator linkage difficult to make work correctly.

water-based, has a milder odor and is easier to clean up. Balsaloc does take a bit longer to dry—no big deal.

EQUIPMENT

My Dimwatt is powered by a 6V Speed 400 motor (actually, a Robbe* 400/35) turning a Graupner* 6x3 folding prop. Power is supplied by seven Sanyo 500AR or 600AE cells and is metered by a Lofty Pursuits* mini speed control/BEC/cutoff. This unit also provides power for the receiver and shuts the motor down in plenty of time to keep the radio system working on the energy left in the motor battery.

The radio system also includes two Hitec* HS-60 servos for the rudder and elevator, a Hitec/RCD Micro 535 receiver and an old reliable Airtronics* SR transmitter.

EQUIPMENT INSTALLATION

I ran into a couple of problems here. First, trial installation of the equipment as shown on the plans revealed that the plane would come out very nose-heavy. I wound up putting the receiver behind the servos in the aft fuselage. It's a bit difficult to get to back there, and I' ll have to cut some covering away to access it again.

Also, I couldn't make the suggested "piano wire in Sullivan tubing" pushrod for the elevator work smoothly. The routing of the cable or wire to the elevator horn has to be just right—straight and aimed at the top of the elevator horn—or the pushrod will flex fore and aft to move the elevator. To get the control throws down to the recommended values, both the elevator and rudder horns need to be taller than those shown on the plans. The March '97 plans revision shows taller control horns and an equipment arrangement that will balance properly.

Thanks to the clever wing-mounting arrangement, removing and replacing the wing can be done in seconds, so it's easy to change flight batteries without the complication and weight of a separate battery hatch. I like this feature so much that I'll probably copy it!

FLYING IT

Ready to fly, my Dimwatt weighs 15.9 ounces with a 7-cell 500AR battery for a wing loading of just under 10 ounces per square foot and a power loading of over 70 watts per pound. Those numbers indicate lively flight performance, and I wasn't disappointed. The Dimwatt is a ball to fly. It's well-mannered and responsive, handles a breeze well for such a lightly loaded plane and is also surprisingly fast if you put its nose down a bit. Last Sunday, when the Dimwatt was in the air with two or three .40-size glow planes, one of the wet-power pilots remarked, "That thing really scoots!" The Dimwatt packs a lot of fun in a small package. Now I see why the "Speed 400" class of models has become so popular worldwide.

*Addresses are listed alphabetically in the Index of Manufacturers on page 182.

FLIGHT PERFORMANCE

• Takeoff and landing

Hand-launching is easy; just toss it firmly into the wind. At full throttle, the Dimwatt climbs out quite smartly. It will easily ROG from a smooth surface in 50 feet (or less with a headwind). Just a little rudder is needed to hold it straight on the ground. Note that I was planning to be able to taxi and do touch-and-go's, so I installed a steerable tailwheel in place of the fixed skid shown on the plan.

Landings are pretty easy as well, but the model really likes to be "3-pointed." For smooth landings, it helps to carry just a little power in to touchdown. Because the Dimwatt is so lightly loaded, it can be slowed down well for full stall landings in the grass.

After a bit of practice, I made some pretty decent touch-and-goes. It helps a lot to increase power just before touchdown so the motor is beginning to accelerate again just after the wheels touch. There's no excess prop clearance, though. It would help if the landing gear legs were taller.

• Low-speed performance

With a wing loading of just under 10 ounces per square foot, the Dimwatt's power-off stalls cause its nose to drop just a little before it tries to continue flying. If you insist by holding full up-elevator, you get a series of small stalls and falls, with no tendency to pay off on one wing. Power on, it is capable of tight climbing circles with no tendency to snap out—very good manners indeed.

• High-speed performance

This was a surprise. A little down trim and the Dimwatt really gets up and goes. I guess the low drag of the squared-off trailing edges is proven to me now! Of course, the controls are quite responsive at high speed, and this underscores the need to have the throws near the recommended values. I found a little downthrust (I put a 1/32-inch-thick ply shim between the lower front of the motor and the mounting plate) was helpful for power-on vs. power-off trim.

• Aerobatics

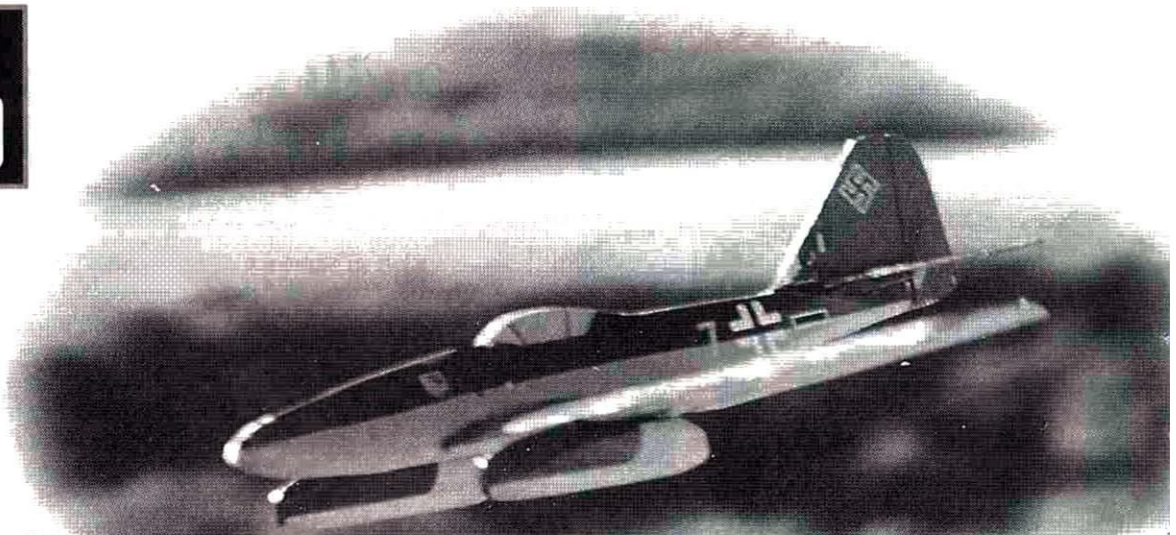
Big round loops and small quick ones are no problem. After some practice on the elevator timing, I've been able to get as many as three consecutive rolls to the right. It rolls much more reluctantly to the left. Very little down-elevator is needed to hold the nose up in inverted flight—a surprise for a flat-bottom wing. But the Dimwatt really wants to roll out, so extended inverted flight is tricky. Since the stalls are so gentle, I've not gotten it to snap-roll yet. A sudden stick-in-the-lower-corner move results in a big barrel roll rather than a snap.

• Duration

My flights have lasted between 3 and 6 minutes so far, depending on how much throttle restraint and which battery pack I use. I've no doubt it will soar in any reasonable lift. Typical flights on the 500AR packs are 4 to 5 minutes of a mixture of full-bore climbing, aerobatics and cruising, with a landing or two thrown in. The 600AE pack provides shorter flights.

The author's 3-year-old daughter, Barbara, poses with the 34-inch-span model.

MODEL AIRPLANE NEWS
HOW TO



Work with EPP Foam

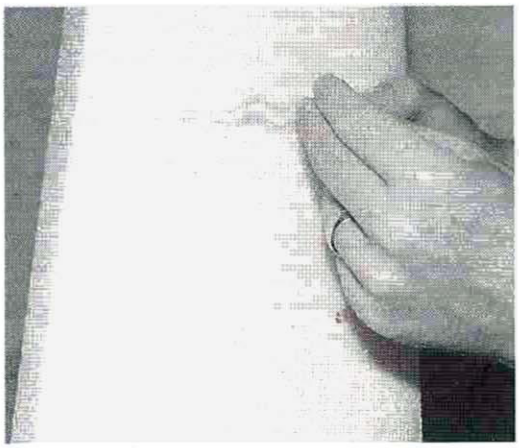
... and make a nearly indestructible model

by DAVID M. SANDERS

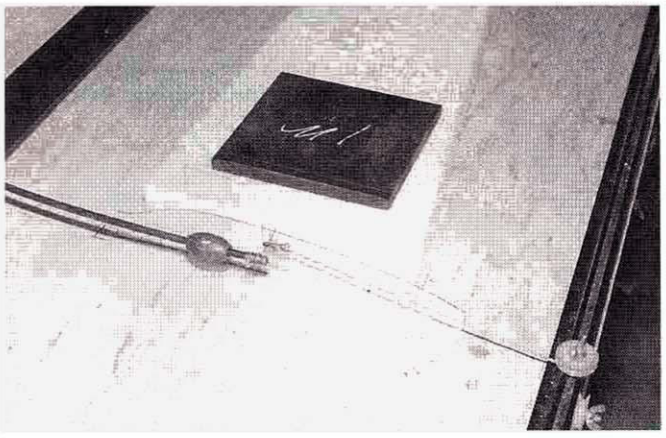
In the world of model aircraft construction materials, there's a new kid on the block: expanded polypropylene (EPP). The latest generation of slope combat sailplanes and sailplane trainers are made of this material, which has proven to be a great advance in the search for the truly indestructible airplane. Want to know more? Check this out ....

ITS PROPERTIES

Unlike the white, beaded foams we've known for years, which are expanded polystyrene (aka EPS or Styrofoam), EPP is made of polypropylene, a very long-chain polymer molecule. As a result, EPP is not crumbly like EPS and is much more difficult to break or tear. It also has incredible memory; a piece squashed between your fingers will spring back to its original form in a matter of seconds! EPP looks a lot like regular beaded EPS and is made by a similar process in which beads of the plastic material are steam-injection molded in a large die to form billets (known as "buns" in the industry). And here's the real topper: it's light! EPP comes in two densities—1.3 lb./sq. ft. and 1.9 lb./sq. ft.—virtually the same densities we're used to working with already.



Peeling "slag" off a wing panel after removing the saddle. By carefully setting the cutting wire's temperature, you can have the slag bunch up into easily removable strands. The part's surface will be as flawless as your templates—even on steep tapers.



Cutting EPP wings using Tekoa's* Feather Cut machine is just like cutting polystyrene foams, except the wire must run much hotter to get reasonable speeds and good clean-out of the kerf.

OK, so what's the downside? As with anything else, there's no free lunch here. EPP can be difficult to work with. Many common adhesives—including our cherished CA—are useless on EPP. Epoxy is of limited value, too. EPP foam is

impervious to practically any solvent or corrosive agent—even battery acid! In addition, you'll need significantly more heat for hot-wire cuts (this, however, has hidden fringe benefits I'll discuss later). Finally, the molded billets are almost always crooked, and their dimensions vary wildly; you must cut straight parts out of misshapen blocks.

CUTTING IT

I cut EPP using two methods: hot-wire cutting (in a well-ventilated area) and band sawing. I consider these the safest methods. Pat Bowman, maker of the Ruffneck and owner of Bowman's Hobbies*, told me he tried exactly once to cut EPP with a table saw, and he recommended that I *not* try doing that myself! Lex Liberato of Studio B*, maker of the Foaminator, uses a router in his EPP armament, but I tried using a router once and consider it suicidal (just my opinion).

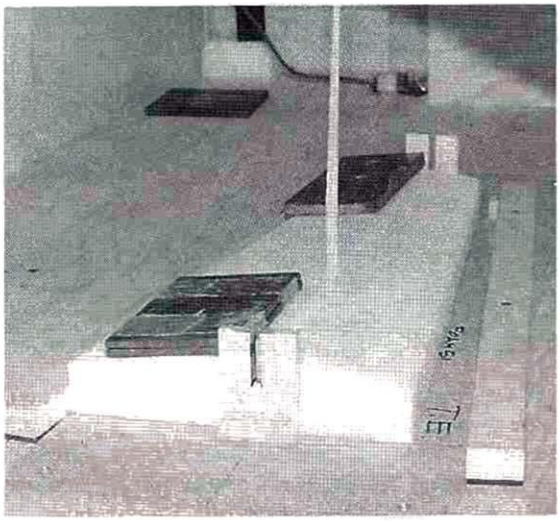
Spar slotting with a hand-held bow. The simple jig is easy to construct and very precise. Hot wire is my favorite method of cutting slots, but routers and soldering irons can also be used to good effect. Be careful using power tools; EPP likes to grab bits and blades.

Hot-wire cutting takes massive amounts of power. I run .025-inch, stainless-steel fishing leader on my bows, and my 36-incher needs about 50 volts at 10 amps to get hot enough to cut EPP efficiently. (Note: if you accidentally grab the bow at the energized ends, you'll "ride the lightning" in a big way!)

After a cut, the parts don't come apart cleanly; they sort of stick together. When you peel the parts away from each other, little hairs of melted foam remain on the part, the bed, or both. I call this stuff "slag." If the cut leaves slag all over the part, then your hot wire is running too cold. If you run it hotter, you can get the slag to bunch up into one or two big strands of melted material that peel away fairly easily. If you run it too hot, though, the slag strand will take some beads of foam with it when you peel it off; this can ruin the part. The best way to find the right temperature setting is by experimenting, but if you take about 15 seconds per inch of cut, you're in the ballpark. Also, you have to pay particular attention to your templates because the high heat settings can actually melt a groove in the guide edge if the wire stalls. Be vigilant always! I use countertop-grade Formica for templates.

BAND SAWING IT

Band sawing this stuff is a breeze and is actually my favorite method of cutting EPP. (A scroll saw also makes short work of it.) I use very coarse blades that have four to six teeth per inch; these seem to clean out the kerf most efficiently and allow extremely tight radius cuts. One thing to watch for while cutting on the band saw is scrap pieces that can be sucked through the lower guides and then melt from the blade friction. This can leave a sludge of EPP on the blade and wheels, which can create extra tension and cause your blade to break. Although not a huge danger, it's certainly an inconvenience (I go through a *lot* of band saw blades). Although EPP has a tendency to dull cutting edges, I've found that even aged band saw blades can still make clean cuts in the foam.

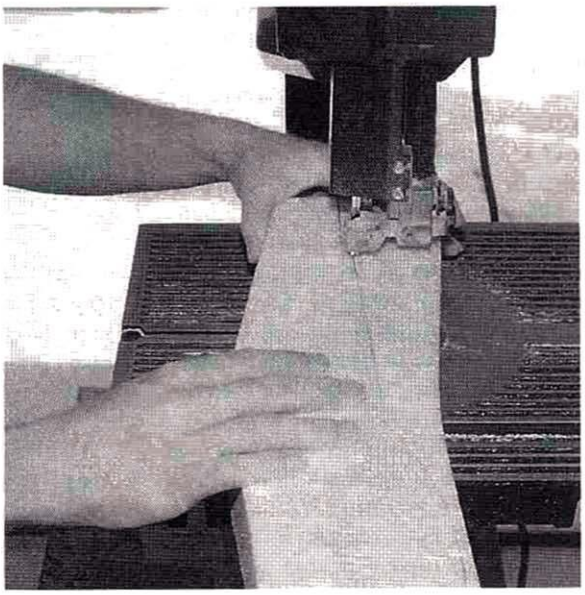


Peel the waste from slotting operations quickly or it will tenaciously stick in the slot as the hot foam cools. Notice the waste strip's incredible flexibility; I can easily pull it out in one, long piece.

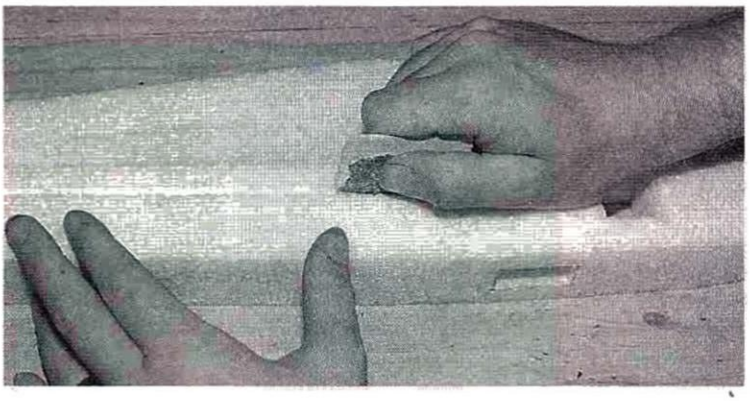
SHAPING AND SANDING IT

Yes, you can actually sand this stuff, but it sure doesn't sand like wood! Very gritty (80 to 150) paper can cut pretty quickly. My favorite way to do bulk shaping is with sharp (I said *sharp!*) razor knife blades. Keep handy either a healthy supply of blades or a sharpener. Never struggle with cutting; if the blade hangs and pulls off chunks, it's dull. Sharpen or replace it. Another tool that I've heard works well is a good ole Stanley Sureform rasp used with light pressure. You could also use a miniature hot-wire cutter.

The best way to sand EPP is with power equipment. A benchtop disk or belt sander



Band sawing an EPP fuselage is joyfully easy. Even a scroll saw can cut the foam very cleanly and effectively. Coarse-toothed blades work best to ensure good clean-out of the kerfs and minimal binding of the blade in its guides.



Using gritty sandpaper wrapped around a piece of wood makes it quick and easy to cut slots. Note cavities in fuselage for installation of radio equipment. Neatness pays!

will walk right through a piece of EPP and leave a very clean surface that's nearly as clean as a saw cut. One problem with power sanding, though, is a tendency for the foam to "grab" the wheel or belt. This can also ruin a part and scare the hell out of you when the machine pitches the part across your shop. Always use a slow feed rate and hold the part firmly.

You'll also be cutting cavities to install radio equipment and stuff. Good tools for this are a sharp razor knife or even a pen-type soldering iron. Be careful with the soldering iron, because the foam retains heat for a long time and can burn you.

REINFORCING IT

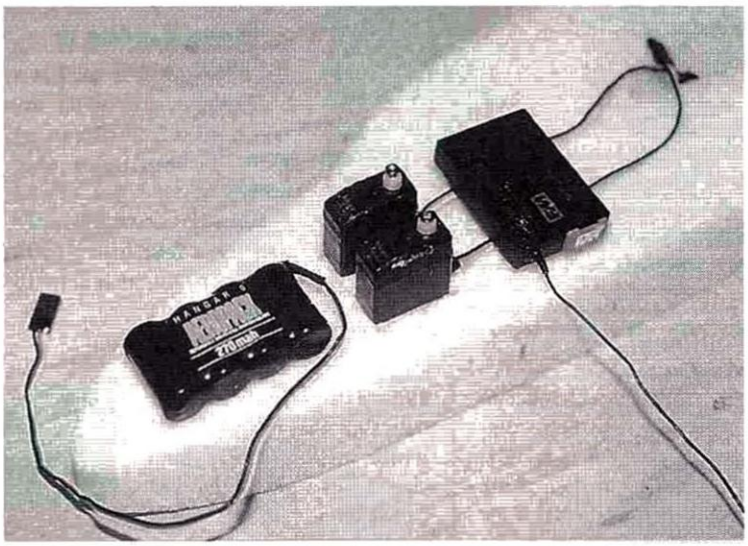
Some EPP foam components—especially wings—will require stiffening. This is generally accomplished by putting sticks of wood or carbon fiber inside the foam or adding strapping or vinyl tape to the outside.

Other than pushrod housings, most conventional EPP combat planes don't have any rigid stiffening agents in the fuselage construction. Tape does the job of keeping the fuselage stiff and break-resistant. Wings, on the other hand, do require a spar and are often equipped with wooden ailerons or trailing-edge strips like that of traditionally constructed aircraft. I prefer using basswood spars. A benefit of using rectangular materials like wood is that the foam can't rotate around the spar, as it can if you use a tubular spar. This, however, can also largely be controlled by using tape. Other makers use spruce or even carbon-fiber spars.

Three types of tape are commonly used now. The first is vinyl, which is used on Trick R/C's* Zagi and Razor combat wings. Vinyl imparts plenty of torsional strength for lightly loaded airplanes. Some conventional models rely on vinyl tape, too.

The second type of tape that's often used is strapping tape, the fiberglass-reinforced packaging tape sold by stationery or office supply stores. I don't skimp on tape; I look for high-quality stuff with large section filaments. The brands with fine, closely spaced filaments just aren't strong enough.

Finally, there's plain, unreinforced packing tape. Mark Mech of Aerofoam*, maker of the EPP foam F-4U Corsair, likes to cover his airplanes entirely with Mylar packing tape and then uses sign vinyl as a final skin.



To ensure a good fit, it's helpful to lay out your radio gear before you cut the cavities. Spacing of 3/8 to 1/2 inch between cavities is usually sufficient, but more is better.

One note about the packaging tapes: they disintegrate quickly in UV radiation, so if you want a long-lasting airframe, you need to cover the tape with something. This leads us to final finishing materials ....

COVERING IT

There are quite a few options other than the vinyl tape mentioned above. All require that a coat of contact cement—either Weldwood or 3M Super 77—be applied to the raw foam before covering; they'll stick to the Mylar tape pretty well on their own. Also, be sure not to run your iron cold! EPP is not nearly as sensitive to the heat of the covering iron as Styrofoam. I run my iron at exactly the same temperature that I use to cover wood, which is pretty hot. I set my TopFlite* iron at 2.75 on a scale of 0 to 3. One final note on coverings: I like materials I can shrink over and over again. If your plane gets beat up and wrinkled after a day's hard use, a quick once-over with the iron can get it looking as good as new.

• **Ultracote* original recipe (not "Plus").** My personal favorite for a scale finish. I've found it gives me good results every time, has predictable characteristics and lasts a long time. A drawback is that it's one of the heavier materials.

• **MonoKote*.** Useless on EPP. Don't even try it; it just won't stick.

• **21st Century Film*.** Works very well, but is cantankerous about heat settings. If you're already a 21st Century user, you'll be in heaven.

• **Model Research Labs* 1.5 mil Mylar.** This stuff is awesome; it's very light and incredibly strong. It goes on just like any other covering film. A big drawback is that it only comes in clear.

• **Micafilm*.** Yes, Micafilm! It works quite well over Balsarite* or 3M 77 Spray adhesive. It can be tricky to work with, has a limited semitransparent color selection and low shrinkability, but it's very lightweight. A good possible choice for foamie HLGs.

STICKING IT TOGETHER

A big challenge in developing EPP airframes was figuring out how to join parts. Here's a rundown of adhesives that work for various applications in the airframe:

• **Household Goop.** This can be found in most hardware and craft stores and comes in a bright purple tube. It's probably the best all-around adhesive for joints that can't be reinforced in any other way, such as with tape or covering film. I use Goop for attaching wings and tail feathers to my planes. It comes in many varieties, but I think they're all pretty much the same. They all have the unmistakable smell of Ambroid cement and are based on the same solvents.

• **Shoe Goo II.** Similar to Goop, but a lot more viscous and a little tougher to work with. Both Goop and Shoe Goo have very short shelf lives, but Goop seems to last a little longer.

• **Hot-glue gun.** This is by far the most popular adhesive because it's fast. Goop and Goo can take days to cure, but hot glue only takes a minute or two. If you work fast, even large components like spars and trailing edges can be installed with hot glue. I use it for gluing into the airframe anything that will later be taped or covered over, such as spars and servos.

• **Liquid contact cement.** Products such as Weldwood general-purpose contact cement are excellent for bonds that require no pre-positioning. It's also good for spreading over the foam before covering.

• **3M Super 77 Spray Adhesive.** I use this as an intermediate adhesive under tape or covering film. With the film adhesive and the heat of the covering iron, the Super 77 provides a very good bond on the foam.

My favorite sticky stuff for EPP foam. All are available at hardware stores.

• **Heat.** This is seldom used but is effective for direct foam-to-foam bonds.

• **Carpet tape.** This is surprisingly strong and can be used to attach wings and tail parts to fuselages. In addition, it's easy to replace, if necessary. To use carpet tape effectively, the joints have to fit together really well.

You'll make two kinds of joints on today's modern combat planes: foam-to-foam and tape-to-tape. The tape used to reinforce airframe parts has a Mylar matrix and is as difficult to bond as the foam, so I prefer Goop for tape-to-tape joints. Goop is also effective for installing tail parts to fuselages and winglets to wings.

• **Solartex*.** This works well but is pretty heavy. It's great for painting over. One drawback is that after it has been painted, reshrinking the film can be a real bear because the heat ruins most paints.

• **Sign vinyl.** Comes in many weights and colors. Can be applied over Mylar packing tape. Looks good and is sun-tolerant, but it's definitely on the heavy side.

One trick to covering with iron-on films is not to shrink a part until it's completely enveloped in the film. If you try to shrink the pieces one at a time, they'll just keep shrinking until they reach the lower limits of their dimensions and they'll never get tight. Instead, cover a part completely, with only minimal shrinking in the middle of each piece of covering. After all the edges of the separate pieces of covering are sealed to each other, shrink the whole part at once. This can result in incredibly tight, smooth covering jobs.

These radio cavities have been cut using a sharp razor knife. The holes between cavities were done with a sharpened brass tube. A soldering iron can be used for this, but it's stinky and messy. I've settled on a good old-fashioned knife for this job.

HOW DO I GET THIS STUFF?

Kit manufacturers and hobby suppliers of EPP get the foam from packaging manufacturers. The catch is that they buy it in huge quantities. I buy this stuff by the truckload to make my kits, as do other makers and suppliers. Don't despair; you can get just a couple of pieces at a time from Aerospace Composite Products*, Superior Aircraft Materials and Dave's Aircraft Works* (my company). Call for prices and availability. Also, EPP costs about twice as much as ordinary EPS, so get ready for a mild case of sticker shock.

This should give you an idea of what to look forward to in an EPP foam project. It's definitely different and requires the development of new skills, but after you fly an EPP airframe and dork it a few times, you may never want to go back to wood and fiberglass! Good luck and happier landings.

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*

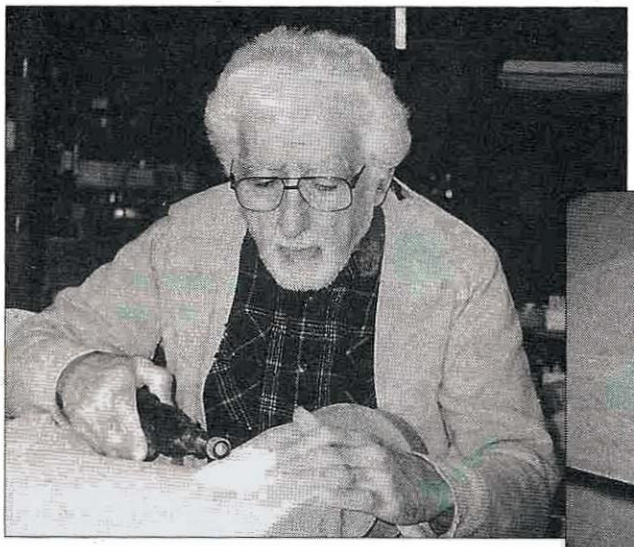
FROM AS FAR back as I can remember, blending and filleting surface intersections have always been a problem for me. Having searched many avenues for a simple and practical method, I succeeded in developing a satisfactory way to apply fairings and fillets and would like to pass it on in hopes that others will find the method as helpful as I have.

MODEL AIRPLANE NEWS HOW TO

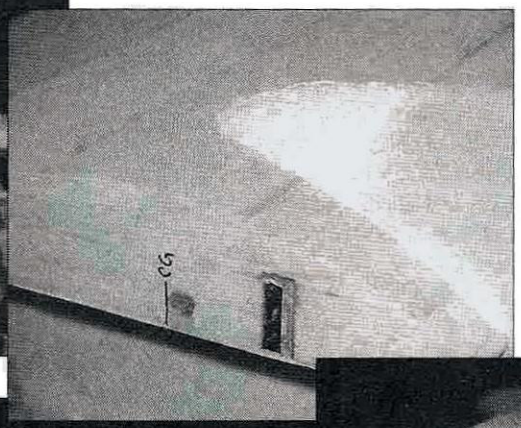
Make Nacelle Fairings

A lightweight solution

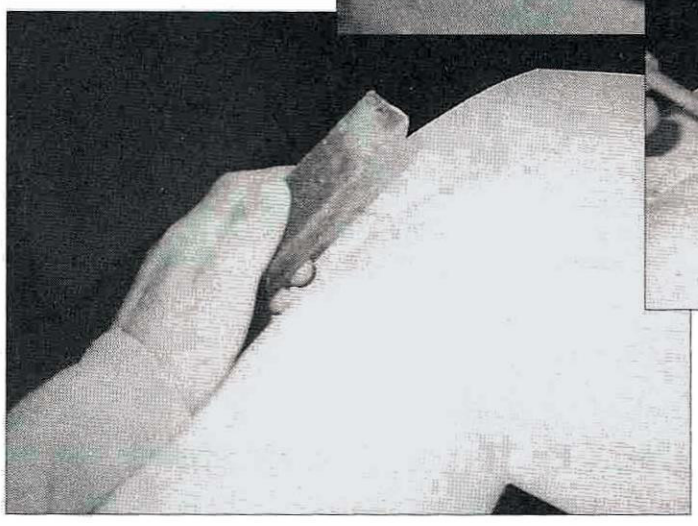
by JOE BESHAR



1 At the fillet or fairing location, position a block of Styrofoam about 1/8 inch below what will be the final contour. (You can use several pieces of Styrofoam as further trimming after assembly; it's a simple matter.) Glue the foam in place with aliphatic white glue, and trim as necessary.



2 Spatula Model Magic* liberally into the recessed area. Model Magic is easy to apply, lightweight and easy to carve and sand.



3 After the Model Magic has set, use 60-grit sandpaper to trim the filler and 120-grit for final contour and finish. After final sanding, wipe or blow off the residual dust.

PHOTOS BY JOE BESHAR

4 Coat the fillet or fairing with Balsarite*. This will glaze the surface to make it compatible with practically any final finish from heat adhesive coverings to paint.

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*

ACRO 1

A QUARTER-SCALE, IMAA-LEGAL AEROBATIC HOMEBUILT

by ROY DAY

WHEN I FIRST SAW a picture of the Acro I on the cover of the June 1994 *Sport Aerobatics* magazine, I thought "Here's an airplane that would make an excellent R/C aerobatics model." The full-scale plane has a wingspan of only 20 feet, so an IMAA-legal, 1/4-scale model would be a convenient size for transport in the average family car. The Acro I is very attractive with its full bubble canopy, molded cowl and colorful red, white and blue finish. When I received an info packet from the manufacturer, Aircraft Technologies, I was definitely convinced. Included in the packet was a short video showing the Acro I doing aerobatics. The lightning-fast rolls and snaps looked more like R/C model aerobatics than full-scale. With this incentive, I set out to design a 1/4-scale Acro I.

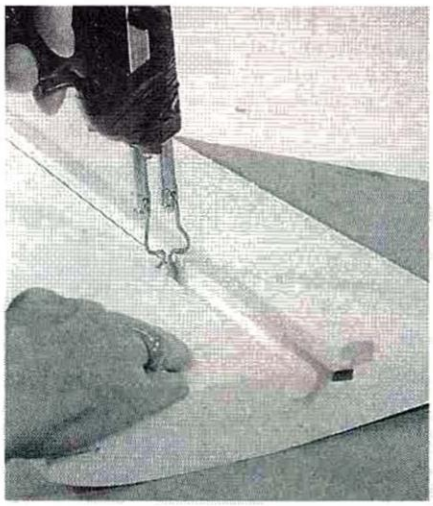
WING CONSTRUCTION

At the outset, I realized that most aerobatics airplanes use a symmetrical airfoil from root to tip. However, I wanted to experiment with a blended airfoil, which would give better stall characteristics (no tip-stall) and yet have the capability for unlimited aerobatics. I chose the NACA 4415 high-cambered airfoil for the tip because it stalls at a higher angle of attack than the NACA 0015 airfoil I chose for the wing root. This results in a gentle stall with little or no wing drop. The easiest way to make a wing with a blended airfoil is

PHOTOS BY ROY DAY

to use foam. If you prefer a full symmetrical wing from root to tip, nothing will change in the wing construction. However, as I have designed it, the Acro I can do any maneuver, from Cuban-8s to Lomcevaks.

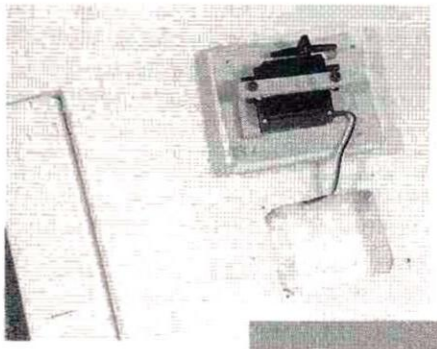
The wing panels were hot-wired from white foam. If you normally put washout in your wings, don't do it here; the blended airfoil does the job for you. Make cutouts for the aileron servos and channels for the servo leads before you sheet the wing with 1/16-inch balsa. I use bare, no. 12 copper wire bent to the desired shape in my soldering gun to make the cutouts. Apply 1-inch-wide filament reinforced strapping tape on the top and bottom of each wing panel, as shown on the plan. Do this before you sheet the wing. The tape strengthens the wing and serves as a sort of "spar." Note that there is no conventional spar; none is needed. For this thick wing, the loads are carried by the strapping tape, the balsa skin and two layers of fiberglass cloth. Also make a saw cut near the leading edge center section and put in a small length of 1/8-inch ply for the wing peg to engage. Now, sheet each wing panel and add leading edge, trailing edge and tip. I used Dave Brown Southerner's Sorghum* contact cement.



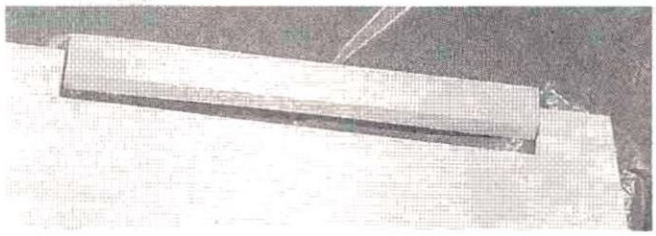
Make channels for your aileron servo leads using bare no. 12 copper wire in your solder gun. Tape a straightedge to the foam wing panel to guide your solder gun, thereby allowing a neat cut.

Join the wing panels upside down on a flat surface so the top of the wing is flat: no dihedral. Add the two layers of fiberglass cloth and resin. Be sure to squeegee off the excess fiberglass resin with an old credit card to give a good, smooth finish with minimum weight. Next, cut out the ailerons and add hinge blocks. Face all the cut surfaces, both aileron and wing, with 1/8-inch balsa sheet. Next, reinforce the wing for the hold-down nylon bolts. I use brass tube bushing with ply doubler and a piece of fiberglass cloth.

Decide how you want to mount your aileron servos and provide the necessary hard points. I mounted my servos on a cover plate, which was attached with screws in hardwood dowels at the corners of the servo cutout. This arrangement makes a neat installation with only the servo arm projecting below the wing surface.



Above: aileron servos can be mounted on the cover of the wing cutout and secured with screws into hardwood dowel inserts.



Below: after sheeting the wing with 1/16-inch balsa, cut out the ailerons and face all cut surfaces with 1/8-inch balsa sheet.

SPECIFICATIONS

Name: Acro I

Type: IMAA-legal, 1/4-scale aerobatic airplane

Wingspan: 65 in.

Wing area: 700 sq. in.

Weight: 8 1/4 lb.

Wing loading: 27 oz./sq. ft.

No. channels: 4 (throttle, elevator, rudder, aileron)

Airfoil:
Root: symmetrical (NACA 0015)
Tip: semisymmetrical (NACA 4415)

Wing mat.: Foam with balsa sheeting

Fuselage mat.: Built-up with foamboard formers

Engine range: .70 to .91 4-stroke, .60 to .75 2-stroke

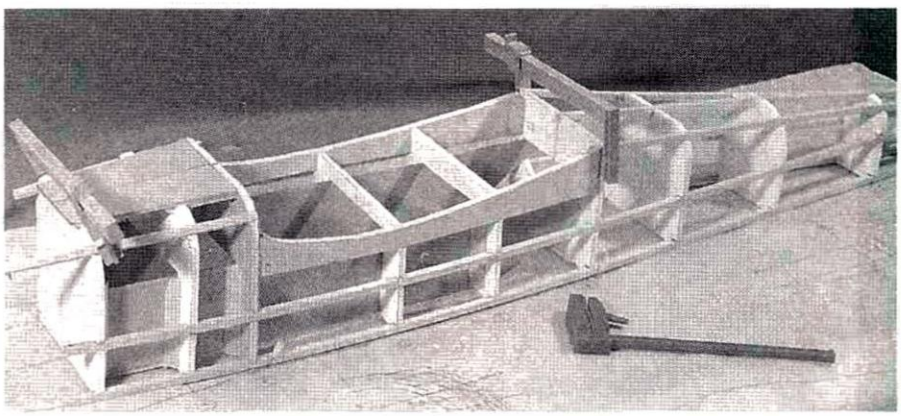
Engine used: Saito .91S 4-stroke

Features: the Acro I is a 1/4-scale, IMAA-legal sport aerobatic model that uses a foam wing and a built-up fuselage. Fuselage construction uses foamboard material for formers and includes a removable tail for simplified transportation and/or repair.

Comments: with the Saito .91S 4-stroke engine, the Acro I gets off a grass runway in a hurry—at less than full throttle—and quickly climbs to altitude. Its responsiveness to commands is pure pleasure. Landings are straightforward, with good control at low speed and no tendency to tip-stall.

FUSELAGE CONSTRUCTION

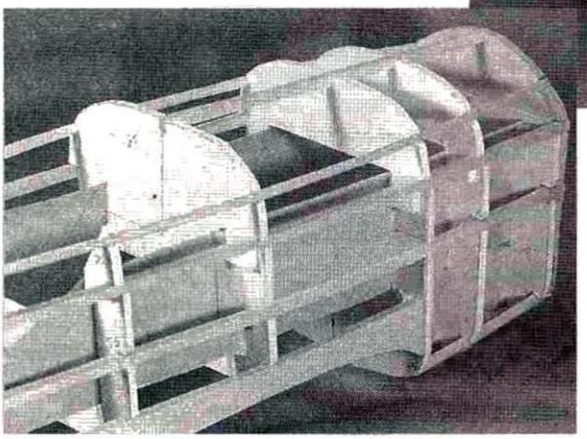
I've used foamboard for formers in the last several airplanes I've built. Use 3/16-inch foamboard, which you can buy in small sheets from art supply stores. Foamboard is an inexpensive composite made of a white foam center that's faced with card stock on both sides. It is quite strong, weighs about the same as medium balsa, never splits and can be sawed, cut and sanded. You must



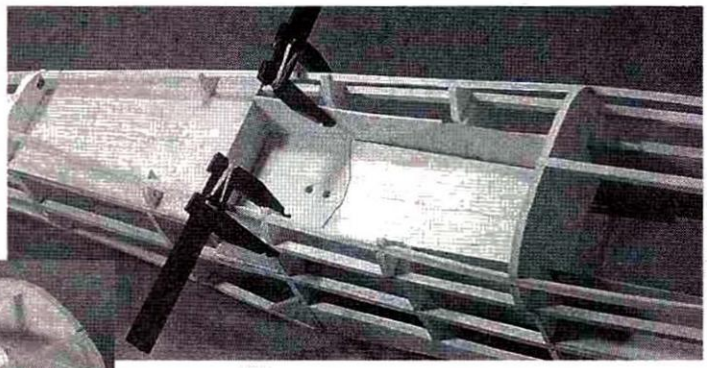
Begin the construction of the fuselage upside-down over your plans. The formers are foamboard. Some have plywood doublers for added strength.

use carpenter's glue or foam-compatible CA. I find I am using more white glue these days and liking it better.

Cut the formers from the foamboard with your scroll saw. Use See-Temp* plastic material to make templates from the plans. Before you start the assembly, cut access holes in those aft fuselage formers for a paper tube for the elevator and rudder servo leads. These servos are mounted in the fuselage just under the stabilizer. Now you can begin to assemble the bottom formers and the wing saddle upside-down on the 1/4-inch-square longerons pinned down on your board. Note that the firewall will be added later, so leave at least 3/8-inch excess on the longerons and on all stringers beyond former 1A so you can tie them into the firewall later. When you have completed all the bottom stringers, remove the fuselage from the board and add the top formers and the firewall. Rather than have the top formers make a butt joint with the bottom formers, use a stronger method and overlap them, as shown on the plans.



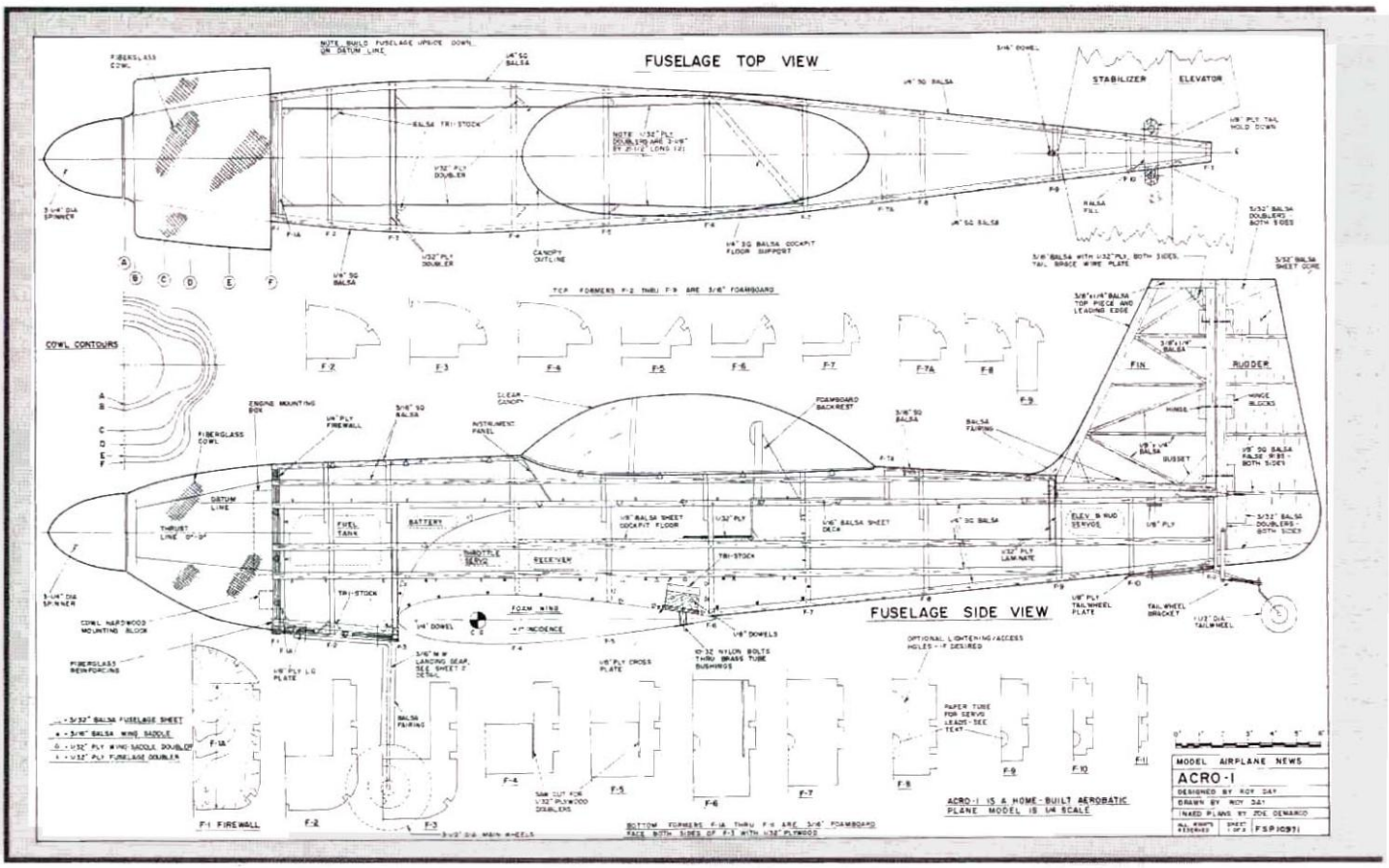
Complete the basic fuselage structure by adding the top formers, firewall and remaining stringers. Overlap the top formers over the bottom ones for a stronger joint.



Build in the cockpit floor and deck behind the pilot. With thin plywood, reinforce the area where you will mount the pilot figure.

Fit the 1/32-inch-ply fuselage doubler inside the formers and secure it with triangular stock at every former. Build mounts for the elevator and rudder servos and build a plywood hold-down, if you go with my design of a bolt-on tail assembly. Now put in the cockpit floor and reinforce it with ply where the pilot figure will be attached. Add the 1/16-inch balsa-sheet deck behind the pilot. Complete the cockpit with a seat back and instrument panel. Next, sheet the forward part of the fuselage and around the cockpit, as shown on the plans. Because of some double curvature on the top of the fuselage, forward of the cockpit, sheet it in sections—not all with one piece.

Depending on your choice of engine and



FLIGHT PERFORMANCE

• Takeoff and landing

No matter how much you've flown, you're always a little anxious when you make the first flight with a new airplane. My nervousness with the Acro I quickly disappeared when I saw how well it handled as I taxied around on the grass field. Conditions were good, with only a slight crosswind, so I advanced the throttle slowly, holding some back pressure on the elevator and a little right rudder to keep the plane straight down the runway. Before I reached full throttle, the Acro I was airborne and climbing sharply. I continued climbing as I made a 180 to return over the field. Then silence: the engine had quit and I faced a dead-stick landing on the first flight! Luckily, I had plenty of altitude and time to try a stall and slow flight before a long glide back to the field for a dead-stick landing. I didn't keep the speed up as much as I should have, so I stalled into a hard landing. The plane sustained no damage except for a couple of broken nylon bolts that hold the landing gear.

Subsequent landings with power have been straightforward, as long as I keep a little power on until the plane is over the end of the runway. Neither a 3-point landing nor landing on the mains is difficult. The airplane has low drag, so plan your approach to bleed off speed before you are over the runway.

• Low-speed flight

Following the emergency test of low-speed flight characteristics when I had the engine out on flight no. 1, I have now flown the Acro I comfortably at low speeds many times. There is no danger of tip-stall, and there is adequate control in all axes with the recommended control throws.

• High-speed performance

The Acro I really comes alive when you give full throttle. Despite its short fuselage, it tracks well and needs no trim changes as you go from low to high speed. A small amount of right rudder trim compensates for the fact that there is no right engine thrust offset.

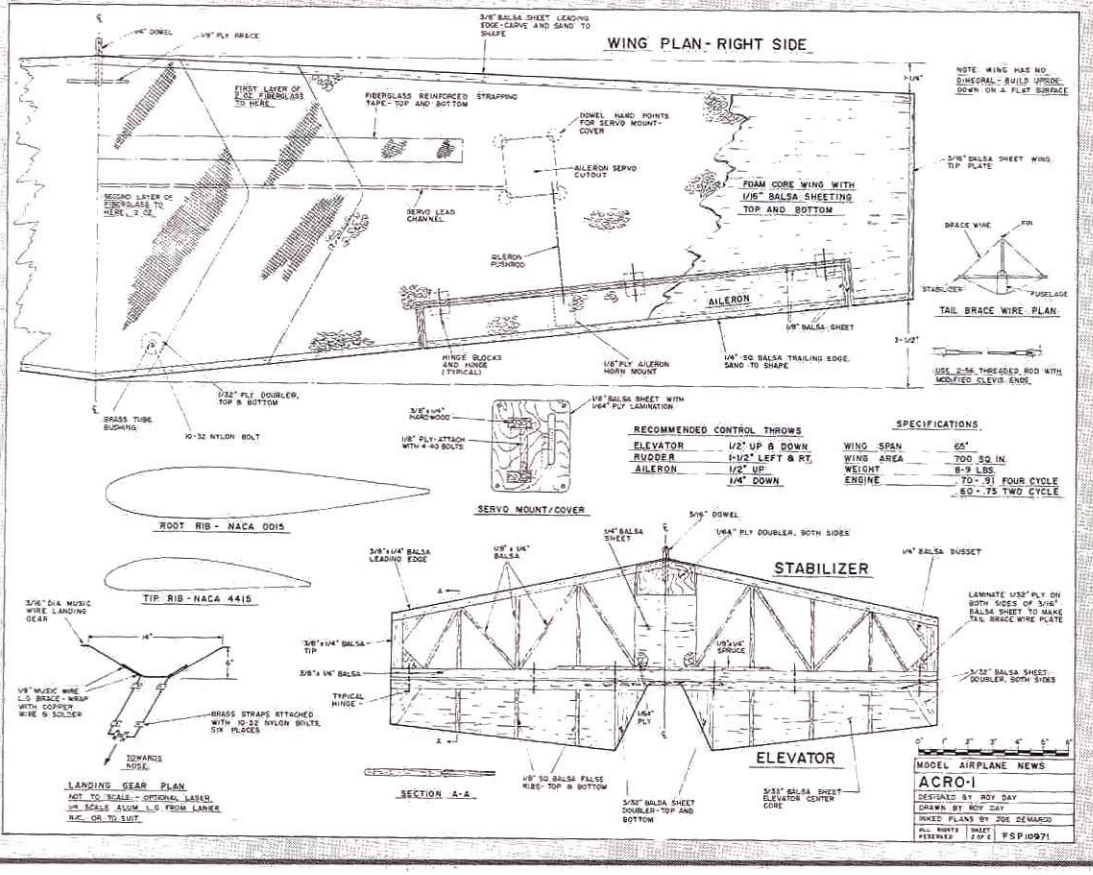
• Aerobatics

This is where the Acro I shines. It has plenty of power for vertical penetration and a minimum of coupling in any axis, so it performs crisp aerobatics in the hands of a good pilot. Slow rolls, Cuban-8s, inverted flight, axial rolls, Lomcevaks—the Acro I can do them all.

mount, you need to build an engine box so that the back plate of the spinner will be about ¼ inch ahead of the cowl. I used a Saito* .91S 4-stroke engine mounted on a Du-Bro* soft mount, which required a ¾-inch extension beyond the firewall. Either build a plywood box or do as I did: use layers of ¼-inch plywood glued together with generous cutouts. I screwed and epoxied this to the firewall after installing blind nuts for the engine mount.

CANOPY

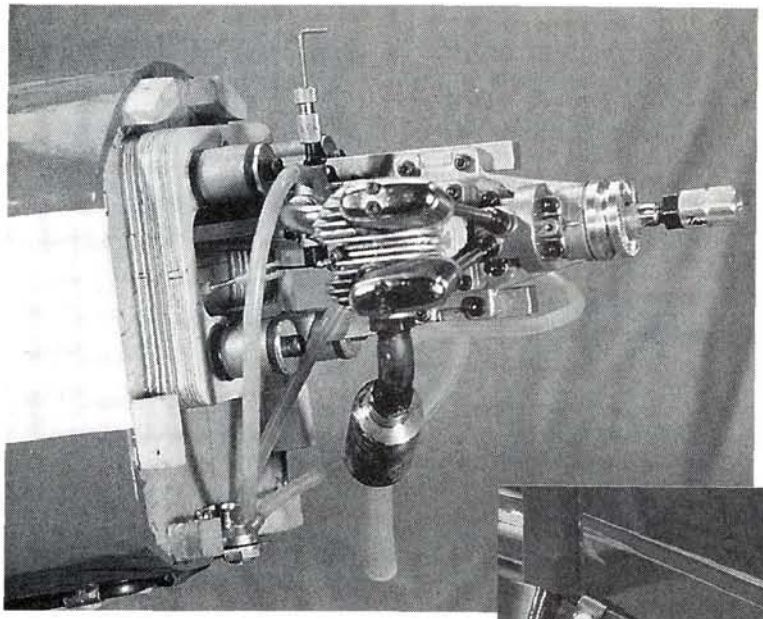
You can make the canopy by either stretch-forming or vacuum-forming Vivak plastic over a plug; I've done it both ways. To make the plug, glue together blanks of pink or blue foam (obtainable from building insulation suppliers). After you've shaped the foam, apply a coat of epoxy resin. Don't worry about a real smooth finish because next you must put on a layer of Bondo (the car repair material). There are several types of Bondo; I used Sun Activated (UV) Bondo, which is made by Dynatye/Bondo Corp. and is available at automotive supply stores.



FSP10971

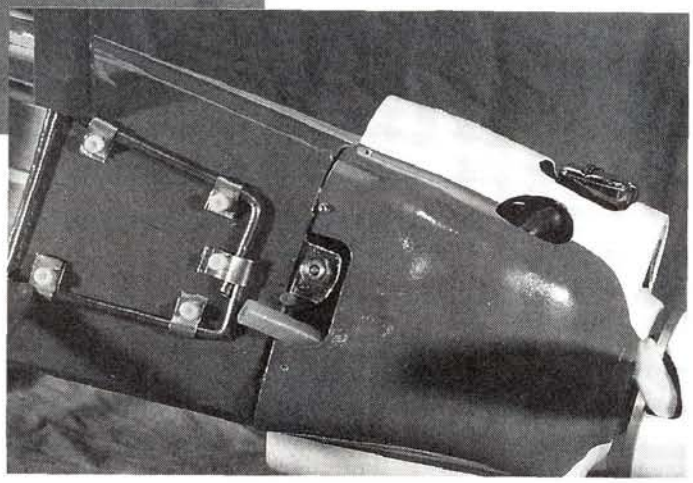
Designed by Roy Day, the Acro I is a ¼-scale aerobatic model of a full-size homebuilt, kit plane. It has a built-up balsa and ply fuselage and a foam-core wing. It utilizes a "blended" semi-symmetrical airfoil with a NACA 4415 airfoil at the tip and a NACA 0015 at the root. Slow-flight characteristics are very good. WS: 65"; radio: 4-channel; eng.: 70 to .91 4-stroke, .60 to .75 2-stroke; sheets: 2; LD 2. $14.95

To order the full-size plans, see Pilots' Mart, page 170.



Left: the Saito .91S 4-stroke engine is mounted horizontally on a Du-Bro soft mount.

Below: this bottom view shows the neat installation of the engine in the cowl with exhaust exiting alongside the fuel-fill valve. The landing gear brass tie-down straps with nylon bolts are also shown.

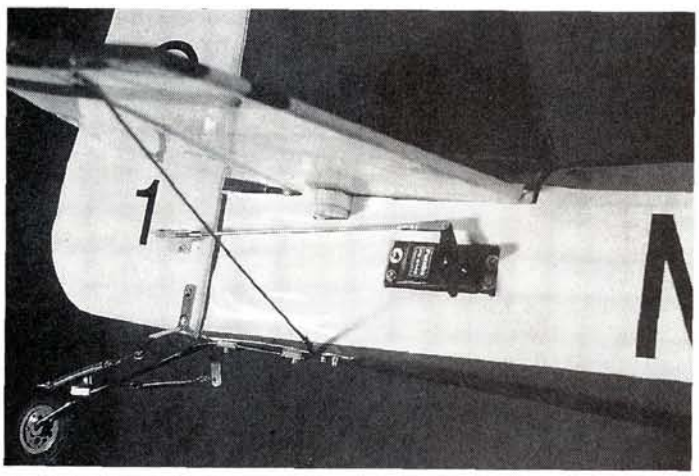


This is a polyester resin, which is why you'll need an epoxy undercoat on your foam plug. The Bondo is the consistency of honey and spreads easily. It will harden in one or two hours in sunlight, regardless of the air temperature. You can sand it to a nice, smooth final finish.

If you don't want to make your own canopy, you can obtain one from me for $15 plus shipping and handling.

COWL

The procedure I used to make the fiberglass cowl is explained in the July 1996 *Model Airplane News* article, "Design and Build a Fiberglass Cowl." This procedure entails building a plug and making a female mold. Of course, you could use a somewhat simpler method to make a foam plug by covering it with two or three layers of fiberglass cloth and resin and then removing the foam by digging it out. This method will require quite a bit of finish sanding. In any case, build the plug of pink or blue foam as described for the canopy. The cross sections of the cowl at various stations are shown on the plans. You could also build the cowl of papier-mâché. That process was described in the article, "Make It with Paper," published in the July 1992 issue of *Model Aviation*. The plug for a papier-mâché cowl could be made the same way, with a coat of epoxy resin to seal the foam. Of course, other easily shaped materials—such as balsa or basswood—could be used for any of the plugs.



The rudder and elevator servos are mounted in the fuselage, just below the horizontal tail. This provides short, rigid pushrods that help prevent flutter.

LANDING GEAR

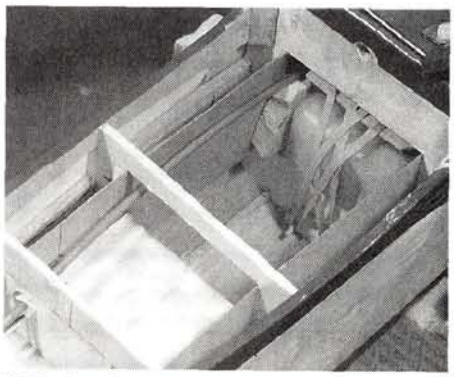
For the main landing gear, you have a choice: build it of 3/16-inch music wire as shown on the plans or buy one of the several aluminum gear on the market. The aluminum landing gear for the 1/4-scale Laser made by Lanier* is the correct size for the Acro I. The plywood landing gear plate is well-reinforced and is tied into the firewall. For either type of landing gear, use nylon bolts threaded into the landing gear plate. A hard landing will shear off the nylon bolts (they're easily replaced), but won't damage your airplane.

The wire landing gear is the torsion-spring type; it's a bit softer than the aluminum gear. It's not difficult to bend the 3/16-inch wire if you have a good wire bender. Use a wire coat hanger to make a pattern of the landing gear and bend the music wire to match.

The tailwheel assembly can be made of music wire, some rectangular brass tube and hardware-store springs. It is a design by Ron Bozzonetti, a fellow flyer in our DC/RC Club. Or you can use a commercial Goldberg* Klett tailwheel assembly.

TAIL ASSEMBLY

The horizontal stabilizer and the vertical fin are standard stick construction. The elevator and rudder use a 3/32-inch balsa-sheet core with 1/8-inch-square false ribs on both sides. Provide hinge blocks for your favorite hinges and build in hard points on the stab and fin to attach the tail brace wires. The tail assembly is glued together and then bolted to the fuselage as a unit, using a 3/16-inch dowel and two bolts. I use this tail attachment method on all of my planes and it's a strong, light way to attach the tail. In addition, it is convenient if you need to remove the tail for repair, incidence adjustment or transport.



With the elevator and rudder servos in the rear, there is room to spare in the forward fuselage. Insulate your fuel tank from it firmly. When this photo was taken, the throttle servo had not yet been mounted on the forward sidewall of the fuselage.

THE REAL THING

The Acro I is a new, single-place sport and aerobatic kit plane designed by Fred Meyer and produced by his company, Aircraft Technologies. The plane is economical to operate, quick to build and yet capable of all aerobatics maneuvers with useful loads of + 10 Gs. It's a small airplane with a wingspan of only 20 feet. The all-composite, mostly fiberglass construction keeps the weight between 700 and 800 pounds. Powered by a 125hp Teledyne Continental IO-240, it has a range of more than 1,000 miles and yet is capable of cruising at better than 200mph.

The full-size Acro I was featured on the June 1994 cover of* Sport Aerobatics *magazine. (Cover reprinted with permission of* Sport Aerobatics *magazine; photo by Jim Koepnick.)

The Acro I is also designed for unlimited aerobatics using a Lycoming IO-360 that's good for 200hp. With the larger engine, the Acro I has a maximum speed of 245mph and a maximum climb rate of 2,800fpm. Its low weight and high power-to-weight ratio give it lightning-fast aerobatics capabilities.

The all-composite Acro I can be built quickly because much of the work has already been done at the factory. For instance, the Acro I kit comes with pre-molded fuselage halves which the builder bonds together, and builders need install only five bulkheads—all without the need for jigs. The quoted time to build the airplane is less than 700 hours, which is far less than the build-time for most kit planes.

WEIGHT AND BALANCE

It's a good idea to do a preliminary weight and balance check of the complete airframe before you cover it. Before checking balance, the servos, battery, tank and engine should be in place. If the airplane doesn't balance at the desired location, adjust the location of the components. The goal should always be to achieve the correct balance without adding any weight. With the components in the locations shown on the plans, the Acro I balances at the 25 percent mean aerodynamic chord (MAC) shown on the plan without any balance weights. The final all-up dry weight of the Acro I is 8¼ pounds.

COVERING AND FINISH

I used Coverite's* 21st Century fabric in red, white and blue to duplicate the finish on the full-scale airplane. The cowl was painted with 21st Century paint in matching colors. Registration numbers and other markings were obtained from a local sign shop that makes computer-generated vinyl characters.

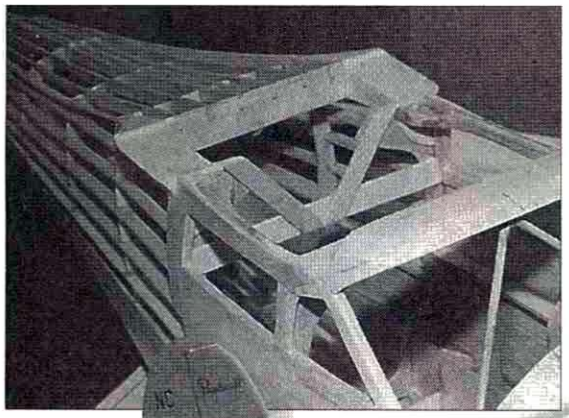
SUMMARY

If you build the Acro I, you can compete with any of the popular aerobatic monoplanes—Extras, CAPs, or Giles. The Acro I is a docile sport plane until you give it full power and head for the blue to do unlimited aerobatics. It's a little different from the usual crowd at the field and will get the attention of your fellow flyers once you put it through its paces. If you're not yet an accomplished aerobatics pilot, the Acro I is just the plane to hone your skills.

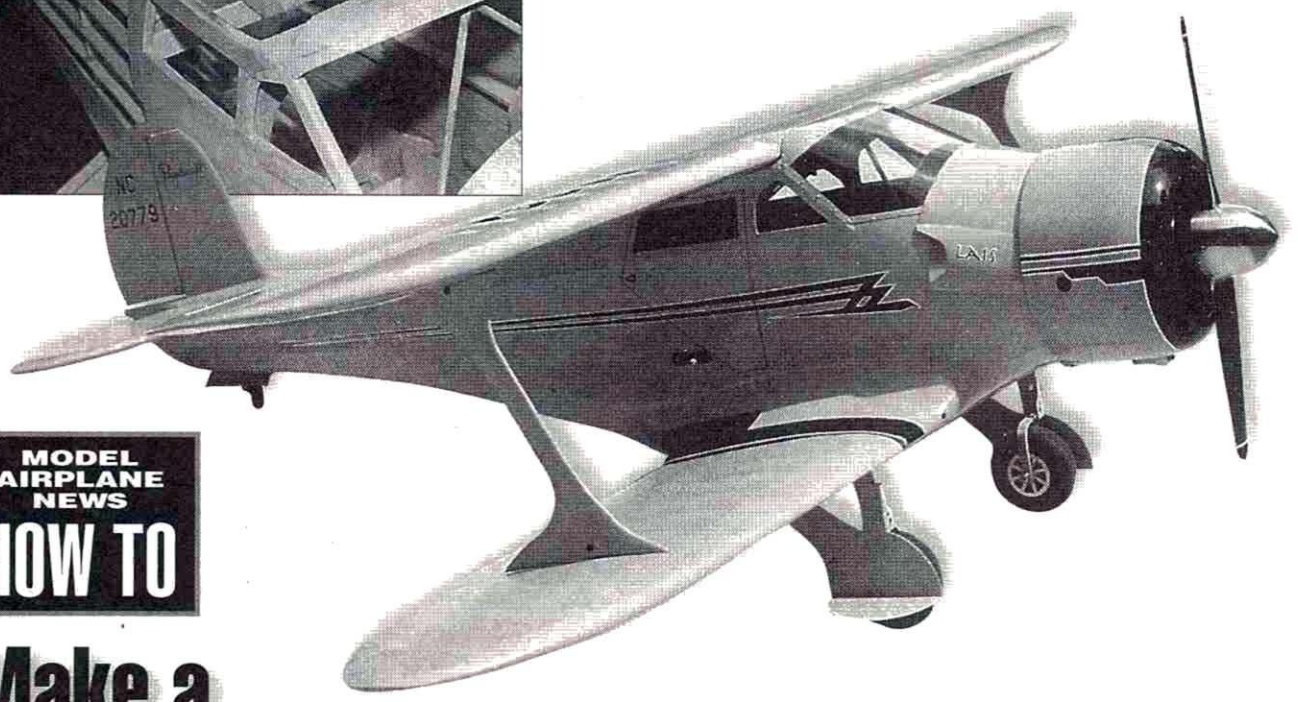
The tail assembly is bolted onto the fuselage as a unit. It is both strong and light.

For any questions or comments, contact Roy Day at 11709 Magruder Ln., Rockville, MD 20852; (301) 468-0915; fax (301) 770-2616.

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*



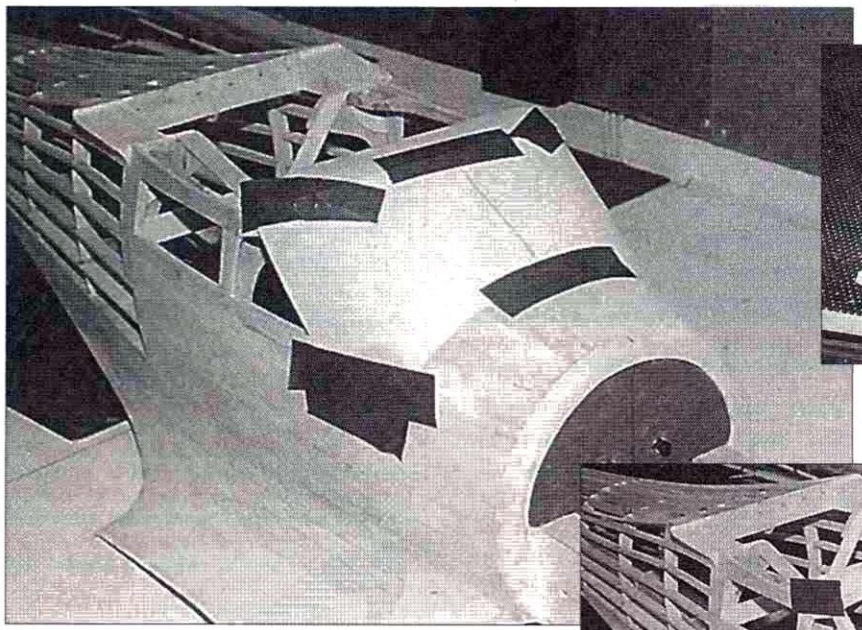
I NEEDED A windshield for this Beech Staggerwing. Since I was going to paint the model and detail the cockpit, I wanted to make the windshield removable so this would be easier. The problem was how to fair it into the fuselage so that it looked scale. Here's what to do:



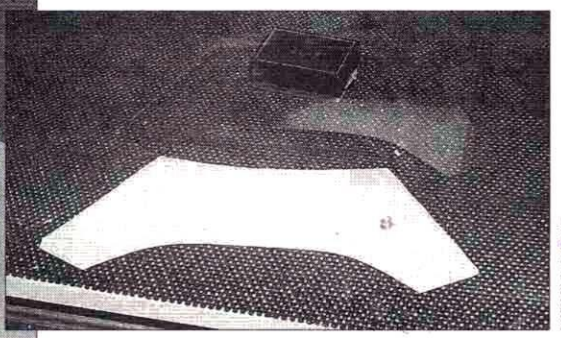
MODEL AIRPLANE NEWS
HOW TO

Make a Removable Windshield

by JIM SANDQUIST

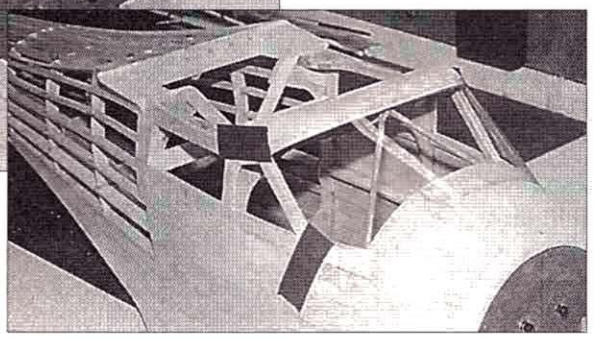


1 Make a paper pattern that fits the fuselage. Tape it in place and trim it until you're satisfied with the fit.

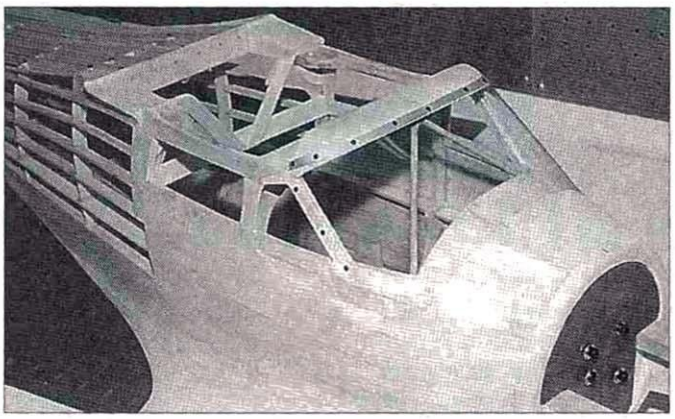


PHOTOS BY JIM SANDQUIST

2 When you're satisfied with the fit of the paper pattern, make one out of plastic.

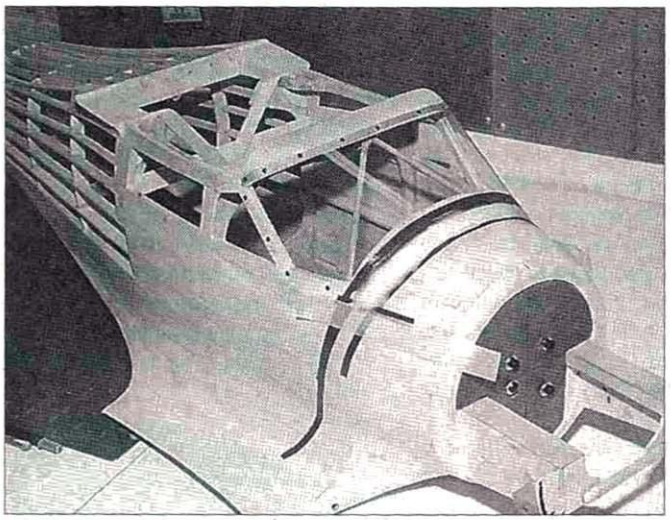


3 Tape the plastic windshield in place.



4 Using your original paper pattern as a guide, cut windshield molding strips out of lightweight aluminum or printer's plate. To hold the molding in place, use small screws that will look scale on your airplane.

All that remains is to make the fairing that will hold the lower leading edge of the windshield to the fuselage. This will be accomplished using Carl Goldberg Models* Model Magic Epoxy Plus, which is flexible and can be easily formed.



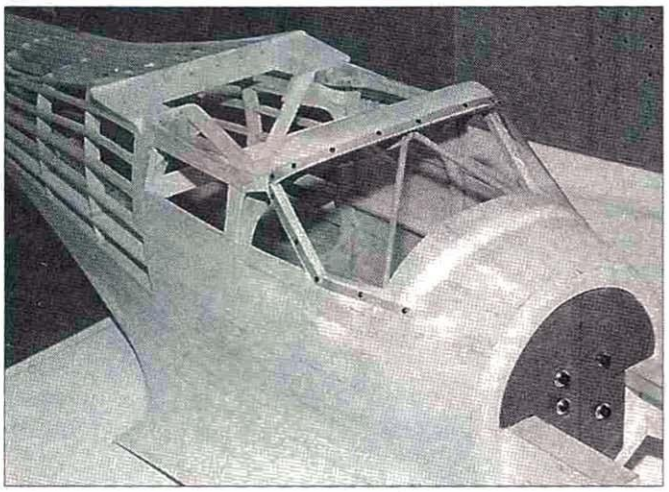
5 Place masking tape on top of and ahead of the windshield to provide the shape of the fairing. Apply a film of petroleum jelly to the leading edge of the windshield on its front and back sides and screw it into place.

Apply Model Magic Epoxy Plus to the fuselage and to the plastic window. Wet your finger to smooth the fairing to shape so that it will require virtually no sanding.

When you're satisfied with the shape of the fairing, remove the masking tape. Wet your finger again and blend the epoxy into the fuselage, then let the epoxy dry overnight.

When you pop out the windshield the next day, you'll find that the epoxy will have worked itself under the plastic slightly to form an actual slot that the windshield will slide into.

6 The windshield in place. When it's time to paint, remove it. If your windshield ever cracks or gets scratched, simply cut a new windshield and replace the old one! The final product looks great, and the windshield is not only removable, but it also has a great scale appearance.



**Addresses are listed alphabetically in the Index of Manufacturers on page 182.* ✚

by DAVE GIERKE

MDS .61 FS AERO

ESTES INDUSTRIES* has diversified its product line. For decades, it serviced the needs of the model rocket community with kits, engines and accessories. Recently, it acquired Cox Hobbies Inc., the longtime manufacturer of engines, plastic ready-to-fly models and other model-aviation-related items. To supplement these relatively small engines, Estes contracted with the Russian MDS organization to import a line of larger displacement engines. Six models ranging from the .15 FR Speed engine to the .61 FS Aero provide an impressive lineup that's capable of competing against the world's best.

Touted as, "Designed by Russian aerospace engineers and manufactured by aerospace machinists," MDS engines are also promoted for their "... performance, dependability and ... savings." The .61 FS Aero is the subject of this month's evaluation.

GENERAL INFORMATION

First impressions are important in any highly competitive business, and model engines are no exception. Starting with an expensive four-color box (primarily red with black, gold and white) and continuing with a high-quality tool assortment, colorful decals, detailed instructions, warranty and safety warnings, the engine and its support materials are complete and professionally packaged.

The engine is a handsome combination of gray satin investment castings, black-anodized aluminum components and black Allen-cap screws. These are highlighted by the reflectivity of a polished aluminum carburetor and various lathe and milling-machine operations, including the engraved "Made in Russia" declaration on the side of the left mounting lug.

The MDS .61FS follows a popular design configuration, with:

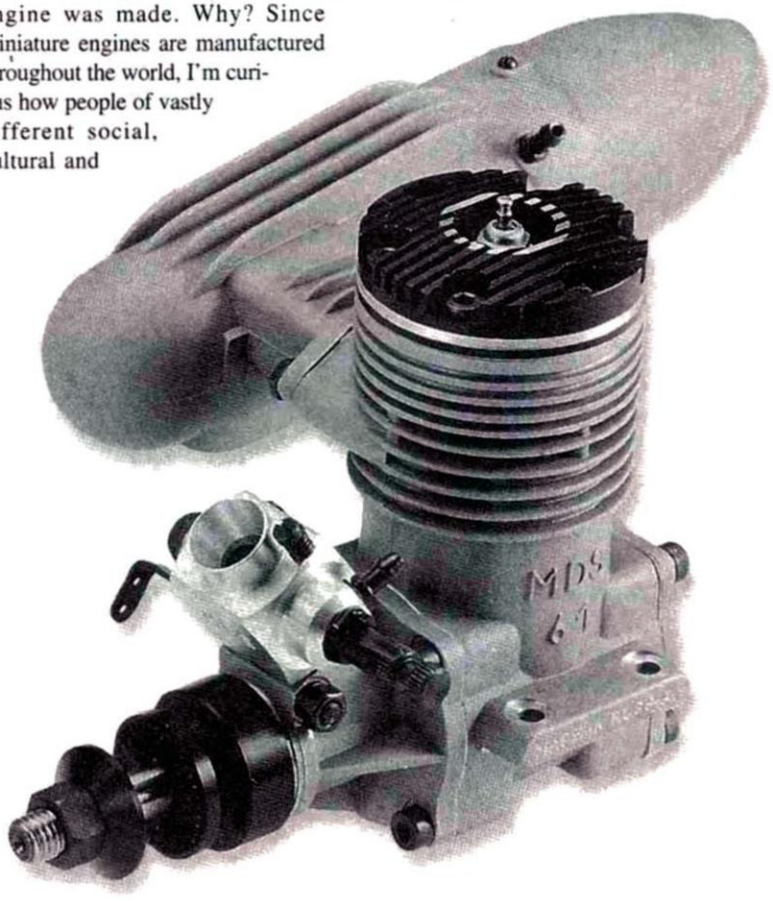
- Front rotary shaft induction
- True ABC piston and sleeve
- Schnuerle transfers with boost ports
- Squish-band head
- Side exhaust
- Dual ball bearings
- Twin-needle carburetor

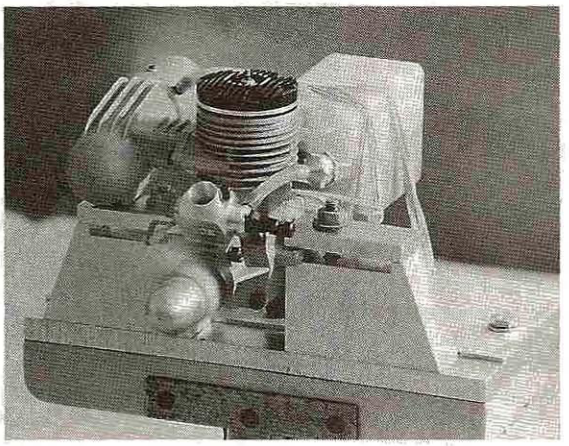
CONSTRUCTION DETAILS

• **Crankcase.** On close inspection of the investment-cast crankcase, it appears that MDS engineers have utilized a foam model (expanded bead) in place of its more common wax counterpart. Although this technique produces parts with somewhat diminished surface detail compared to the more expensive lost-wax process (see sidebar), the results are nonetheless acceptable.

Whenever an engine component is surface finished, e.g. bead-blasted, it offers me the opportunity to play detective to determine the sequence of machining operations. Yes, believe it or not, your faithful engine-review columnist is actually interested in how the engine was made. Why? Since miniature engines are manufactured throughout the world, I'm curious how people of vastly different social, cultural and educational backgrounds solve common technical problems. Many European countries still promote and cultivate a paradigm rejected by us a generation ago: skilled manual machine operators. In other parts of the world, including America, many modern production machines are controlled by computer (CNC, or computer numerical control), where technicians are responsible for programming and tending to the machine's tools. Without proclaiming a black or white preference for either philosophy—there are drawbacks and benefits to each—let's see how the MDS group solves the crankcase machining problem.

Many engine manufacturers use the mounting lugs on the crankcase casting for their initial machine setup. By clamping these securely to the machine, the first operations—usually drilling—are performed. The success of these operations is wholly dependent on the dimensional accuracy of the casting. As an example, die castings hold their size very well and offer an excellent platform for fixturing to a machine within a few thousandths of an inch. At the other end of the





The MDS .61 FS Aero running during break-in on a sturdy, vibration-free test stand. Notice the level of the fuel tank in relation to the primary needle valve; keep as much tank volume above the needle as below for consistent runs on suction or muffler pressure. A fuel filter is a must. ABC-type engines should always avoid the over-cooling effects of 4-cycling operation.

spectrum, sand castings, which are typically rough and sometimes distorted, offer a questionable starting point from the aspect of being flat and square. One engine manufacturer had great difficulty with its sand-cast crankcases in the early 1970s. Many of these were machined so misaligned that they were scrapped or required special modifications to straighten them out. In terms of machine fixturing, the following are ranked from best to worst: die cast, investment cast, permanent mold cast and sand cast.

After lug-clamping the raw MDS crankcase to the machine, the top of the case (where the head is attached) was turned flat by a lathe operation. Next, it was tap-drilled with six equally spaced holes for the eventual attachment of the cylinder head by Allen-cap machine screws. The four engine-mount holes were also drilled at this time. This sequence is probable because the mount holes, top of the case and the bottom of the head screw holes (where they emerge through the cooling fins) have been bead-blasted.

After the partially machined crankcase had been removed from the lug-clamping fixture, it was totally surface-finished by the bead-blasting process. Next, the case was fixture-clamped against its finished cylinder-head interface. A milling-machine operation then "surfaced" the bottom of the engine-mount lugs along with the front and rear of the case where the crankshaft housing and rear cover are attached. Then it was horizontally bored along the crankshaft centerline. Finally, four holes were drilled and tapped in the front and rear of the case where the crankshaft housing and rear cover are attached with Allen-cap screws.

The crankcase was again returned to the lug-clamping fixture where the vertical boring operation was performed along the cylinder centerline. The six screw holes for mounting the cylinder head were then tapped (this was done after bead-blasting because the threads were still shiny). As you can tell, the surface-finishing process provided vital clues necessary for speculation about production details.

Some manufacturers are oblivious to the outward appearance of their engines, while others spend time and money to produce a visually pleasing product. When you're thinking about purchasing that new engine, look closely. Although outward appearances can be deceiving, manufacturers who care about aesthetics usually care about the internals.

• **The MDS .61 front housing and rear cover** is investment-cast with soft aluminum gaskets at the crankcase interface. They are retained by hefty Allen-cap machine screws. The carburetor is secured to the housing by a steel drawbar mechanism in conventional fashion. A small-diameter hole (0.030 inch) is drilled from behind the outer race of the front bearing (at the top) to the front of the housing's induction hole, just below the neck of the installed carburetor. This technique is used by several designers to solve a potential fuel leakage problem through the front crankshaft bearing.

• **Piston.** The piston is cast from high-silicon aluminum alloy. The top 0.100 inch of the piston is tapered 0.012 inch to prevent its top edge from hooking a port. Strangely, the MDS .61FS has about *10 times* more piston taper than most other manufacturers of ABC-type engines. Initially, I was concerned that this exaggeration might lead to premature piston degradation on the exhaust-port side; this portion of its face is directly exposed to high-velocity, high-temperature combustion gases as they exhaust (blow-down) from the cylinder. The saving grace of the configuration lies with the engine's relatively low *effective* compression ratio, which limits the combustion temperatures. On a theoretical level, does this feature confuse the port opening point? When does gas transfer begin? Realistic thinking suggests that gases start flowing *before* the piston crown reaches the top edge of the port.

ENGINE SPECIFICATIONS

Displacement	0.603 ci
Stroke	0.860 in.
Bore	0.945 in.
Stroke/bore	0.91:1
Engine dimensions—H x W x L	4.2x2.465x4.9 in.
—width between bearers	1.7 in.
Mounting-hole dimensions	
—fore-aft	1 in.
—side-side	2.065 in.
Weight—bare	530 gm/18.7 oz.
—with muffler	653.5 gm/23 oz.
Crankshaft thread size	8x1.25mm
Carburetor bore diameter	0.350 in.
Timing (port and induction)	
Exhaust—open	76°BBDC
— close	76°ABDC
—period	152°
Transfer & boost—open	62°BBDC
—close	62°ABDC
—period	124°
Induction—open	41°ABDC
—close	48°ATDC
—period	187°
Compression ratios	
—geometric	11.4:1
—effective	8.1:1
List price	$109.95

Features: front rotary shaft induction; true ABC piston and sleeve; Schnuerle transfers with boost ports; squish-band heads; side exhaust; dual ball bearings; twin-needle carburetor.

Comments: the MDS .61FS is a handsome combination of gray satin investment castings, black-anodized aluminum components and black Allen-cap screws.

Hits
- A very professionally prepared package of software and hardware.
- A very user-friendly engine from the aspect of starting, adjusting, and running.
- A competitive price

Misses
- The Russian glow plug can't be gripped with our standard head-lock battery connectors.
- Relatively ineffective muffler (97dB).
- Some parts over-tightened at factory.

INVESTMENT CASTING

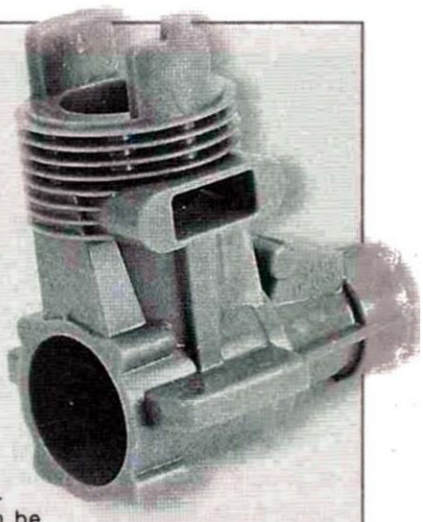
Investment casting is also known as the "lost wax" process. The term "investment" refers to the special mold material that surrounds a ceramic-covered pattern. In this process, a wax pattern must be made for every casting and grating system (where metal enters the runner that leads to the mold cavity); the pattern is expendable.

Advantages of this method:

- A high degree of accuracy is possible. Machining on castings of difficult-to-reach places, such as bypass passages, is eliminated—one of the great virtues of the process.
- Castings of great exterior and interior intricacy may be achieved.
- Thin sections can be cast because the heated mold promotes the flow of molten metal into these tiny areas.

THE PROCESS

1. A female die for the part to be cast, e.g. a crankcase, is made of aluminum.
2. Positive wax patterns are produced by injecting hot wax into the die.
3. The wax assembly is next invested in a mold; an investment-molding mixture is poured around the wax pattern to form the mold. Molds are allowed to air set.
4. Wax is melted out of the hardened mold by being heated in an inverted position at 200 to 300°F (the wax may be reclaimed and reused). Slowly, the molds are heated to about 1200° F to complete the wax removal; at this temperature, any remaining wax vaporizes.
5. Before casting by gravity pouring, the mold temperature is reduced to about 500°F. Air pressure may then be applied to force fill the mold cavity. In some cases, pouring is done in a centrifuge to fill out thin sections.



Investment casting represents the best method of casting precision miniature engine parts, but it's expensive and costs about 10 times as much as a representative die casting. Engines exhibiting the highest levels of performance (and cost) typically use the lost wax (investment) method of casting.

• **Wristpin.** The hardened, ground-steel alloy wristpin is retained in the piston by two music-wire retainer clips in conventional fashion.

• **Cylinder.** The chromed-brass cylinder sleeve is very sturdy; its wall thickness (0.100 inch) is greater than that of any other 10cc powerplant reviewed to date, and it adds substantially to the engine's overall weight. Two conventional Schnuerle transfer ports are angled away from the exhaust port, while two huge boost ports slant steeply toward the top of the sleeve.

MDS has found it necessary to remove potentially damaging chrome flashing (could cause piston scoring) from all ports where they contact the cylinder bore. This hand operation was performed with a die-grinder equipped with a rotary file.

The heart of the engine: piston, rod, wristpin and cylinder. This true ABC assembly (chrome, not nickel plating) represents state-of-the-art thinking.

• **Connecting rod.** Machined of bar-stock alloy aluminum, the rod is bronze-bushed at the crankpin end and provided with a single, 0.030-inch-diameter lubrication hole.

• **Drive washer.** The bar-stock-aluminum drive washer is held securely to the crankshaft by a tapered split cone also made of aluminum. The drive washer is anodized black.

• **Cylinder head.** The one-piece, black-anodized head has an angled squish band (2°) and a single, deep, hemispherical combustion chamber (0.208 inch).

• **Crankshaft.** The twin ball-bearing-supported crankshaft has a 0.415-inch-diameter induction hole bored through a 0.590-inch-o.d. journal. Constructed in one piece, the steel-alloy unit is case hardened and ground to size. The nose thread is 8x1.25mm.

• **Carburetor.** The aluminum body carburetor has a conventional steel barrel assembly with a 0.350-inch-diameter air-induction hole. The twin-needle design follows standard practice. An O-ring helps to seal the carburetor neck to the front housing.

I had great difficulty removing the carburetor from the front housing. The draw bar was loose, but the unit was tightly jammed. I was eventually able to remove it by turning the carburetor body back and forth. The portion of the carb that enters the front housing was found to be bent out of round by an overtightened draw bar. The problem was resolved by removing the high spots on the carb neck with a flat needle file and fine emery cloth.

The primary needle valve was screwed in tightly against its seat; breaking it free required slip-joint pliers for leverage.

OPERATION

It was a pleasant surprise to find that MDS recommends a test-stand break-in procedure for the MDS .61FS. The detailed operating instructions cover all aspects of the procedure, including engine mounting, fuel-tank positioning, propeller selection and installation, starting the engine, idle needle settings, fuel, after-run oil and glow plugs.

Although they recommend 10-percent nitromethane and 20-percent castor oil for the fuel blend, I decided to stick with my tried and true mixture of 15-percent nitro and 20-percent lube split 50/50 between Klotz Racing Castor and their KL-200 synthetic. The additional 5-percent nitro provides consistent performance comparisons with other engines of similar size and design configurations.

There's one section of the instructions concerning the engine's operating speed during break-in that I'd like to clarify. This is going to sound like a broken record to most of my regular readers, but I feel it bears repeating for the sake of prolonging the life of all ABC-type engines. Estes states, "Once the engine has started, *allow it to warm up* [emphasis added] for about 30 seconds. After this period, turn the high speed needle clockwise until you notice an audible increase in the rpm." ABC-type engines should *never* be run 4-cycling rich. This over-cooling condition causes premature wear to the critical interference fit at the top of the piston. I would prefer to add the following, "... allow it to warm up for about 30 seconds *at a rich 2-cycling rpm. ABC-type engines should never be allowed to 4-cycle, due to premature wear of the piston.*"

I selected a slightly smaller propeller for break-in purposes than recommended in the instructions (10x6 Zinger)—a matter of personal preference. The atmospheric conditions were ideal: temperature—65°F, barometric pressure—29.20 (uncorrected), wet bulb thermometer—58°F.

The MDS .61FS started easily, ran smoothly and responded quickly to the primary needle valve as I adjusted it to a slightly rich 2-cycling rpm. It was operated for 3-minute periods with brief speed-up sessions toward the end of each run (about 5 to 8 seconds). Initially, the tach registered 14,200rpm and improved steadily as break-in progressed. Toward the end of the 45-minute break-in period, the MDS maintained a sweet 14,800rpm.

The family of components that make up the MDS .61 FS Aero. This is a very popular design configuration for the '90s.

Next, a group of APC propellers were selected, run and tached for comparison with other similar powerplants: 11x6—13,500rpm; 11x8—12,200rpm; 12x6—11,500rpm; 12x8—10,200rpm; 11x10—10,100rpm; 13x7—9,700rpm; 11x12—9,100rpm.

The APC 11x8 was chosen as a likely candidate to be used with a typical trainer or sport model. At wide-open throttle and 9 feet from the muffler side of the engine, the dB reading for sound was 97. Using the same propeller, the carburetor was adjusted for maximum reliable idle (2,700rpm), as per instructions.

SUPPORT INFORMATION

Estes supplies a very comprehensive "Safety Instructions and Warnings" sheet with each of its engines. Their 26-point list is something all power modelers should be familiar with. As they say in the introduction, "Your MDS engine is not a toy. Handle the engine with care, as it is a precision-built machine capable of harming you or others if ... you fail to observe these safety instructions."

Estes offers a 3-year limited warranty for MDS engines. The product is guaranteed to be free of defects in materials and workmanship for a period of 3 years from the date of purchase (except for ball bearings, which are covered for 90 days). During this time, MDS's authorized service center will repair or replace any defective parts without charge.

Should the engine require non-warranty repair service, Estes provides detailed instructions concerning its return, repair cost estimate and return policy.

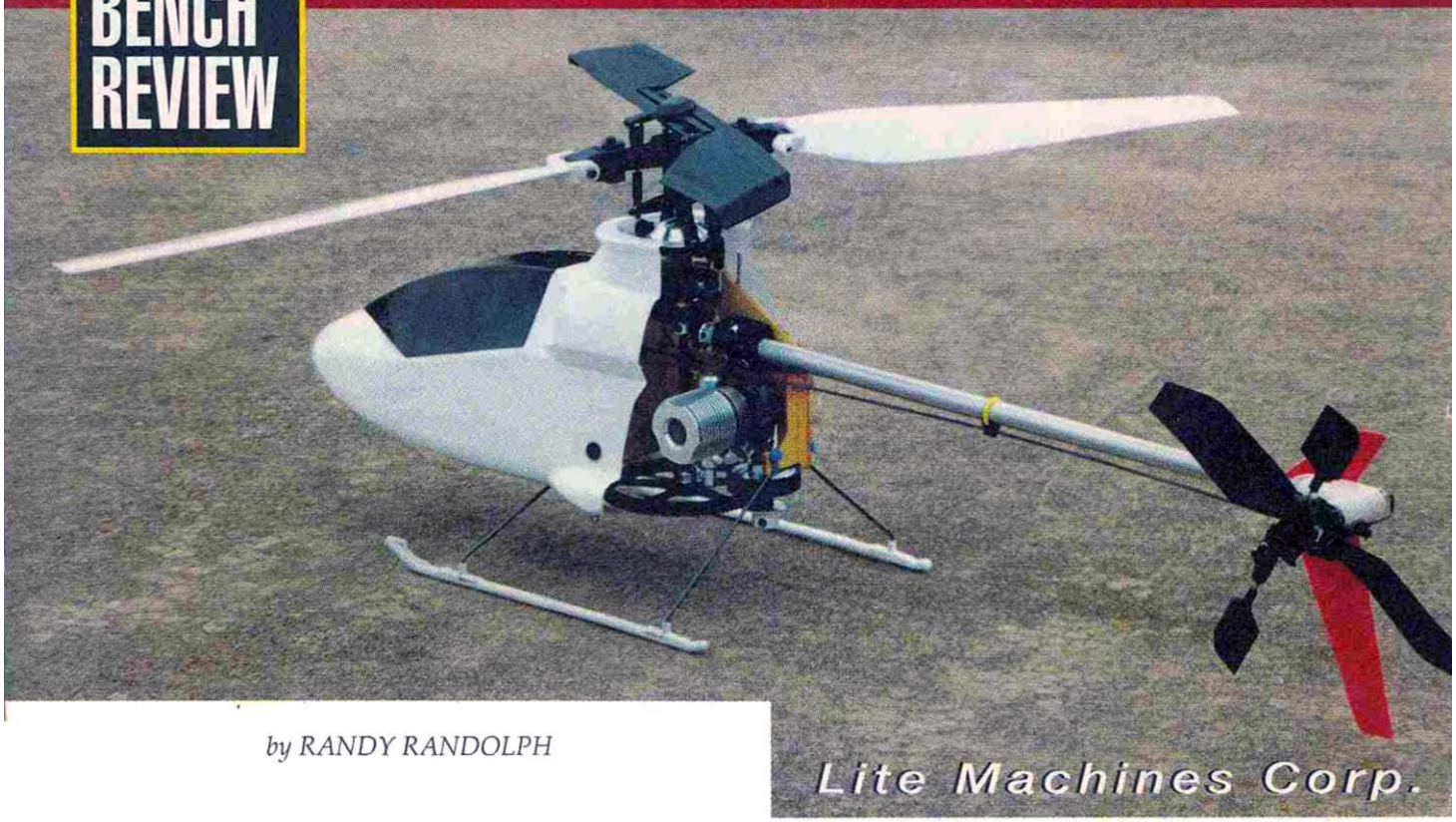
Engine and carburetor pictorial diagrams provide an easy to use reference for parts identification and ordering numbers.

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

This little .06-powered whirlybird is big on fun!



by RANDY RANDOLPH

Lite Machines Corp. 100+

WHEN I WAS asked to review a helicopter, my first thought was, "No, thank you!" But I have a weakness for small airplane projects, and when I found out that the Lite Machines* 100+ was powered by a little .06 engine, I decided it was actually my *duty* to give it a try. As I'm totally unfamiliar with helicopters and what makes them do what they do, I was absolutely dependent on the instruction manual. That dedication to the written word, along with the exploded views and numerous illustrations, resulted in a truly great building experience that produced a rather complicated machine as easily as if one of the designers had been at my elbow the whole time!

FIRST IMPRESSIONS

Professional! This kit was manufactured by intelligent people who take pride in their work. All mechanical parts were individually packaged and housed in a strong cardboard box and separated from the plastic canopy and plywood parts. Nothing in this kit could cause damage to itself, even with fairly rough handling.

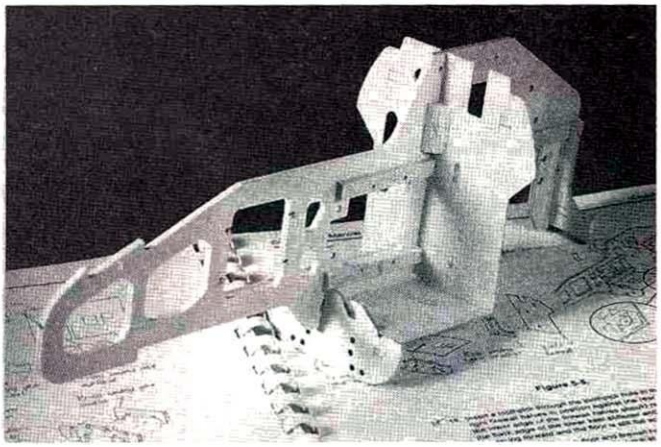
This is a complete kit in every sense of the word. Each assembly is packaged together, so there's no digging through unneeded hardware to find the next part. There's even a small box to keep tiny spare parts that you might happen to need at the field. I built the Basic Package, which includes everything from a throttled Norvel engine with spare glow plugs and special glow-plug connector to the proper lubricant for all moving parts.

ASSEMBLY

Most modelers have all the tools necessary to complete assembly, with the exception of liquid thread-lock and some styrene glue for the canopy. Although the kit includes the Allen wrenches needed for bolts and setscrews, ball drivers of the proper size would indeed be welcome.

Left: the swashplate ball bearing is assembled and filled with grease after assembly. Tweezers are very handy in this operation.

Right: the plywood chassis is the only real construction in the whole kit. The parts are machined and match perfectly with very little sanding necessary before they are fuel-proofed.



The construction manual is a thing of beauty—bearing a resemblance to the Heath Kit manuals of old. Every step is illustrated, and the exploded views are almost as good as having someone at your shoulder telling you what to do as well as anticipating things you might do wrong. This is a step-by-step manual, and they suggest that you follow the steps exactly! That I did, and am very glad of it, because it made assembly smooth and fun! So that you don't lose your place between sessions, check boxes are provided after each step.

The manual is divided into sections for each subassembly, and the first step in the construction sequence is the assembly of the plywood keel, which will house all the vital elements (engine, servos, receiver and batteries) along with their connections to all control and operational mechanics. The instructions suggest sanding the edges of all ply parts and cleaning all holes, notches and slots, but very little cleanup was needed. The only change I made from the manual was to paint the completed plywood keel with thinned epoxy cement rather than the suggested butyrate dope.

The next step was one of the most difficult! The canopy is in halves and must be cut from the sheet in which the halves were formed. The halves are then cemented together with styrene glue. I followed the instructions exactly, but even so, it was a rather tedious job getting both halves lined up perfectly and cemented together. It would have been a snap for a modeler with nimble fingers.

The main-rotor assembly looked like a tough job, and I was hesitant to start. While putting things together, I kept waiting for the tough part, but it never came! I am happy to report that the toughest part was tightening screws! This step is where a ball driver would have been a great help, because some of these screws require a lot of turning with small Allen wrenches. Once assembled on the main shaft, balancing the rotors was not difficult at all, and very little fiddling brought the whole mass into balance.

The swashplate is really just a big ball bearing that must be assembled. It's an easy, but messy, job. The balls are slipped into their race one at a time, and then grease is added after they're all tucked in where they belong. I tried to be neat and dab the grease over the balls with a toothpick, but I finally gave up and used my fingers, which I should have done in the first place. From there on, the rest was easy.

The only glue joint outside of the plywood crutch was the fin cemented to the tail-rotor housing to keep the tail rotors away from the ground. The tail rotors practically assembled themselves, and when the tail assembly and boom were bolted to the crutch, everything lined up just right.

Assembling the gears, clutch and engine to the main-rotor shaft and crutch was a one-two-three job by following the checkoff list and the exploded views. The fuel tank is provided and is mounted on the crutch with cable straps. After the gear was bolted to the gear mounts and the cowl was slipped in place, a complete helicopter was sitting there on the bench looking just as pretty as the picture. All it needed was the radio!

SPECIFICATIONS

Manufacturer: Lite Machines Corp.

Type: helicopter

Name: Lite Machines 100+

Main-rotor diameter: 24 in.

Engine: Norvel Vmax-6 w/SpiraLite plug and throttle muffler (included in Basic pack)

Engine/main-rotor gear ratio: 1:11.3

Tail-rotor/main-rotor ratio: 1:2.1

Radio req'd: 4-channel

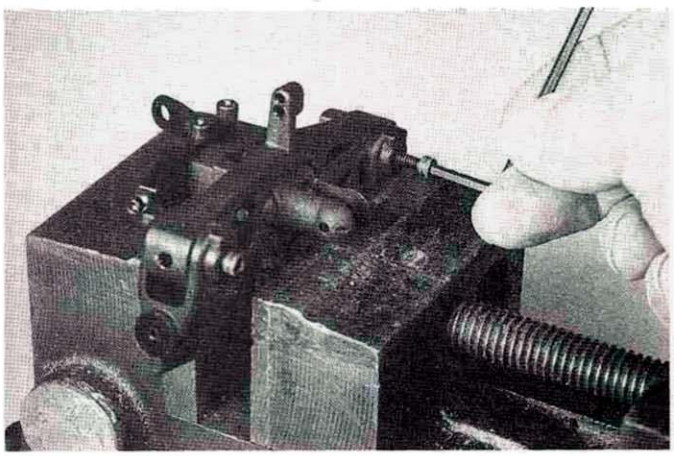
List price: $199 (100+); $268.74 (Basic Pkg.); $389 (Basic Pkg. plus micro-servos, grease and oil); $499 (Basic Pkg. plus complete radio system, grease and oil).

Features: very complete instruction manual and easy assembly. The Arlton Gyro Stabilizer eliminates the need for expensive gyro add-ons.

Comments: because of its great building and operating manuals, the 100+ (my first helicopter!) was truly a great building experience, and flying the 100+ can be mastered by a novice helicopter pilot without too many tense moments.

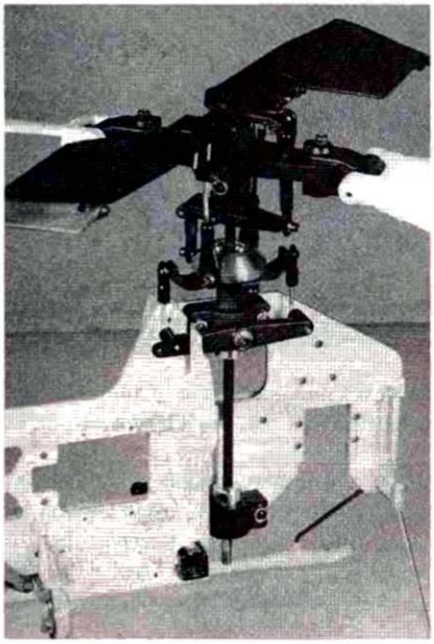
Hits
- Overall design.
- Instruction and operating manuals are first-rate.
- Easy to assemble.
- Perfect parts fit.

Misses
- None found.



PHOTOS BY RANDY RANDOLPH

The main rotor and sub-rotor assembly, as well as some of the other assemblies, are much easier to handle if held in a vise while you tighten some of the screws. Be gentle with the vise when holding pressure.



The main rotor and sub-rotor assemblies are mounted on the chassis with ball-bearing pillow blocks. It is at this time that the rotor is balanced—a rather simple and positive operation.

Four microservos are required for this machine, and the mounts have cutouts for Hitec HS-80s or Futaba S-33s. Others may fit, but those are the only ones I had available. The receiver and battery back are wrapped in foam and strapped to the forward part of the crutch with rubber bands; the throttle and rudder servos are mounted just behind them. The servos for the main rotor control are mounted just under the rotors to keep control rods short and direct. Because of the Arlton Gyro Stabilizer that is part of the 100+, no electronic gyro need be purchased or installed. All in all, it took less than an hour to install the radio, check alignment and test everything.

FLIGHT PERFORMANCE

The first phases of testing were conducted between my shop, my house, two fences and my driveway. Since helicopters are vertical takeoff and landing machines, it seemed silly to go all the way to the field for the initial hops. Besides, I had no desire to embarrass myself in front of fellow club members, should my first efforts at helicopter flight be something other than successful.

The glow plug in the Norvel helicopter engine requires 2 volts to heat up and I used two 1.2V batteries in series as a glow driver. The additional 0.4 volt did not seem to cause any trouble at all. However, a glow driver with a way of varying the voltage would be ideal and is recommended.

Who said hovering was hard to do? (Photo by Helen Randolph.)

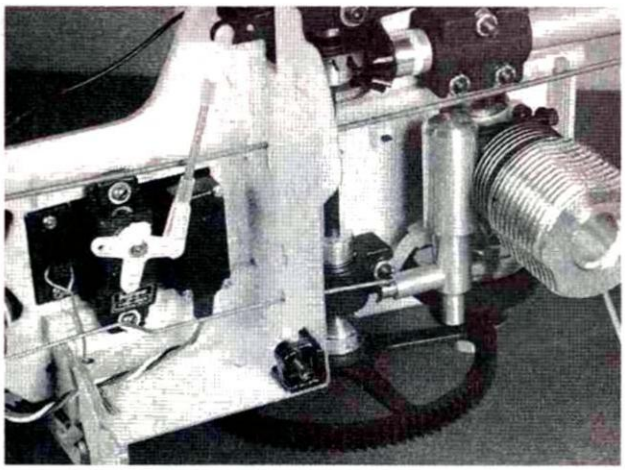
According to the operating manual, I attached crossed, 3-foot-long, 1/4-inch-diameter dowels tipped with ping-pong balls to the landing gear with plastic strips. The fuel tank is easy to reach and fill; now everything was ready to go. As instructed, I advanced the throttle slightly, grasped the machine as shown and applied the starter.

The Norvel engine fired up and leaned out perfectly! The throttle is of the exhaust-restriction type and is a real beauty. The engine follows the throttle stick as smooth as silk, and speed can be varied by extremely small increments—a feature that is most important in helicopters.

Once the engine was running smoothly, with a beautiful idle, the bullet was bitten and the throttle was slowly advanced to lift off. At the first liftoff, the machine started a rotation to the left, just as mentioned in the instructions, so I throttled back and landed. The second liftoff, with a little right rudder, was smooth with no rotation, and with an elevation of about 1 foot and a 20-second flight, I called the initial test a success and throttled back to a fairly nice landing.

Since then, with several real flights under my belt, it has become obvious that up in the air, in forward flight, there is very little difference between the 100+ and any other R/C airplane. It is stable and will fly itself for short periods of time. Control response is more sensitive in pitch than in either roll or lateral control, and there's a lag between control input and effect (compared with flying a fixed-wing model), so some anticipation is necessary. This lag is especially true with the throttle response, which should have been expected! All in all, it would appear that the 100+ can be mastered by a novice helicopter pilot without too many tense moments.

For me, the novice pilot personified, flying (hovering) around the backyard is the most fun of all! The only damage sustained has been a few nicks to the tail boom caused by downward flexing rotors during hard landings—actually not really damage; just battle scars!



The Norvel Vmax-6 engine has an exhaust-restricting throttle that offers control that's almost as smooth as that of an electric motor, allowing precise changes in the power level.

Now it was time to move on to the 60-page operator's guide, which does its very best to talk you through preflight preparation and trimming as well as the first few hours of flight. Again, the illustrations are absolutely first-rate, and the text is written to inform rather than impress! After the first few hours of flying, there are some things you should check to be sure the heli is in first-class condition. These things are covered in the manual, too.

After a radio-range test (even though I had no intention of flying more than a few feet away), it was time to fire up the 100+! My friend and fellow club member Dan Tips lent me his helicopter flight simulator prior to my first flights, and I highly recommend that approach. In about four or five hours of flying the R/C Aerochopper* computer flight simulator, I saved at least $20,000 in busted-up helicopters! Contrary to my first thoughts, helicopters are great fun!

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.* ✦

SR Late breaking news...

By now, most of you have heard about *Techniques*. However, you may not have heard all of the details or what *Techniques* can do for your modeling.

Techniques is a new concept. With *Techniques,* you can easily build your own personal modeling library suited to your personal needs and interests. The basic idea behind *Techniques* is that after reading a volume, you should be able to do something you weren't able to do before reading it. It's that simple. Each volume is so jam-packed with information that if a paragraph were left out, you'd be missing something. No fluff, no bull, just pure "how to" information. If you'd like to be a better builder, finisher, or flyer, *Techniques* is for you.

There are two different editions of *Techniques* and you can subscribe to either or both of them. ***R/C Techniques*** covers the entire R/C field. You'll find information on flying, building, radio systems, and finishing. ***Electric Flight Techniques***, covers Electric Flight from the spinner to tail. All of the tips and techniques that usually take years of trial and error to discover are included. If you'd like to do it right the first time and get the most out of Electric Flight, *Electric Flight Techniques* is for you.

Each Volume of *Techniques* is only $3 including First Class postage to your home. If you'd rather subscribe to *Techniques* for the year so that you get each new volume as it comes out rather than trying to remember to order them periodically, it's no problem. *R/C Techniques* is published on the even months of the year, February, April, June, August, October, and December. *Electric Flight Techniques* is published on the odd months of the year, January, March, May, July, September, and November. A calendar year's subscription to six volumes of either *R/C Techniques* or *Electric Flight Techniques* for 1997 is $15 including First Class Postage. For 1998, a full year's subscription will be $18.

If you subscribe to either editions of *Techniques* at some mid point in the year, you'll receive all of the volumes which have already been published since January of the current calendar year.

Here is some of what's available in the ***R/C Techniques*** archive...

Volume R-1: Rx/Tx Battery Pack Testing

- How can you know how much flying time you will get from a receiver or transmitter battery pack?
- How can you determine the capacity of an older receiver or transmitter pack?
- What is "critical cutoff voltage?"
- Won't your Expanded Scale Voltmeter tell you how much charge is in your pack?
- Is there a way to make an ESV more accurate?
- If you know the capacity of a pack, how can you know how much flying time you will get?
- Is there a more precise way to calculate the average current draw of your system?
- How can you tell if you're using a large enough receiver battery pack?
- How can you tell if you're using the right charge rate for trickle charging?
- How can you tell how much charge your Fast Field charger is putting into your receiver and transmitter packs?
- Will the charger that came with your radio charge a five cell receiver pack properly?
- How does outside air temperature affect the capacity of your receiver and transmitter packs?
- How can you determine if your receiver pack was damaged in a crash?
- How can you tell in the Spring if your packs are ready for the coming flying season?
- Can you still use a pack that's five years old?
- Does a bad reading on a cycler mean you have a bad pack?
- How can a cycler cost you an aircraft?

Volume R-2: Rx/Tx Battery Pack Charging

- How long should I charge my receiver and transmitter packs?
- You said 10% for 14 to 16 hours. Why isn't it 10% for 10 hour? Isn't that 100%?
- What does "ma" and "mah" mean?
- At what rate does the standard charger that came with my radio charge?
- All of this is fine for a 500mah pack but my radio didn't come with a 500mah pack. It came with 700mah pack.
- How large a pack can be charged with the standard 50ma charger that came with my radio system?
- What about a 1500 mah pack? Can it be charged at 50ma too by lengthening the charge time to 36 hours or more?
- Why doesn't lengthening the charge time work?
- How critical is the timing? What if I forget and charge for longer than 14 to 16 hours?
- Does that mean that I can leave a pack on charge at the 10% rate all the time?
- With trickle charging the pack is on charge all the time. Why doesn't that hurt the pack?
- How long can I leave a pack on trickle charge and will it do any damage?
- Can a partially charged pack be trickle charged?
- Trickle charging sounds great. Where can I get a trickle charger?
- What about a pulsed or timed charge instead of a trickle charge?
- Can I just plug my charger into a timer?
- Can I charge a pack in less than 14 to 16 hours.?
- I notice that you cut 14 hours in half to get 7 hours rather than cutting 16 hour in half. Is there any reason you chose 7 hours?
- What about fast charging?
- I hear a lot about using a five cell receiver pack. What are the advantages of a five cell receiver pack?
- Can I use the charger that came with my radio system to charge a five cell pack?

Volume R-5: Everything you ever wanted to know about soldering. Part 1

- What are the two most important factors to successful soldering?
- What are the warning signs that a wire might be hard or impossible to solder?
- What is flux?
- What forms does it come in?
- What's the difference between resin and rosin type fluxes?
- What kind of flux should never be used?
- Why should you use paste flux?
- What solder alloy should you use?
- What do the numbers 60/40 mean?
- When should you use silver solder?
- What sizes of solder should you use?
- What kind of soldering iron should never be used?
- What wattage or temperature soldering iron should you use?
- What size wire should be used for which applications?
- Is 12g wire bigger or smaller than 22g wire?
- How can you make your own holding fixture that's as good or better than anything you can buy?
- Where, when and how should you apply the heat from the soldering iron?
- How do you know when the soldering iron is hot enough?
- How do you keep the tip clean?
- What are the two simple soldering exercises that will make you an expert in no time?

If you'd like more information, just send us a SASE business size envelope with 55 cents postage to SR Batteries, Inc. Box 287 Bellport NY 11713. Email: 74167.751@compuserve.com Phone: 516-286-0079

by GEORGE LEU

TOP GUN TIDBITS AND HATCHES

Plans for this Martin B-26 designed by Art Johnson are now available from Jerry Bates.

In general, there has been a trend toward modelers entering original designs in scale competition, and this year, Top Gun featured a separate category for these types of models. Known as Designer Scale, this new category saw 15 individuals competing. A few others did compete with original designs in Team Scale and Expert class, but the majority of the new original designs flew in Designer Scale. Designer Scale competitors truly convey the spirit of Top Gun scale modeling, and I congratulate all the participants. Regardless of which class they're entered in, all the aircraft and the modelers who built them must be considered the Best of the Best.

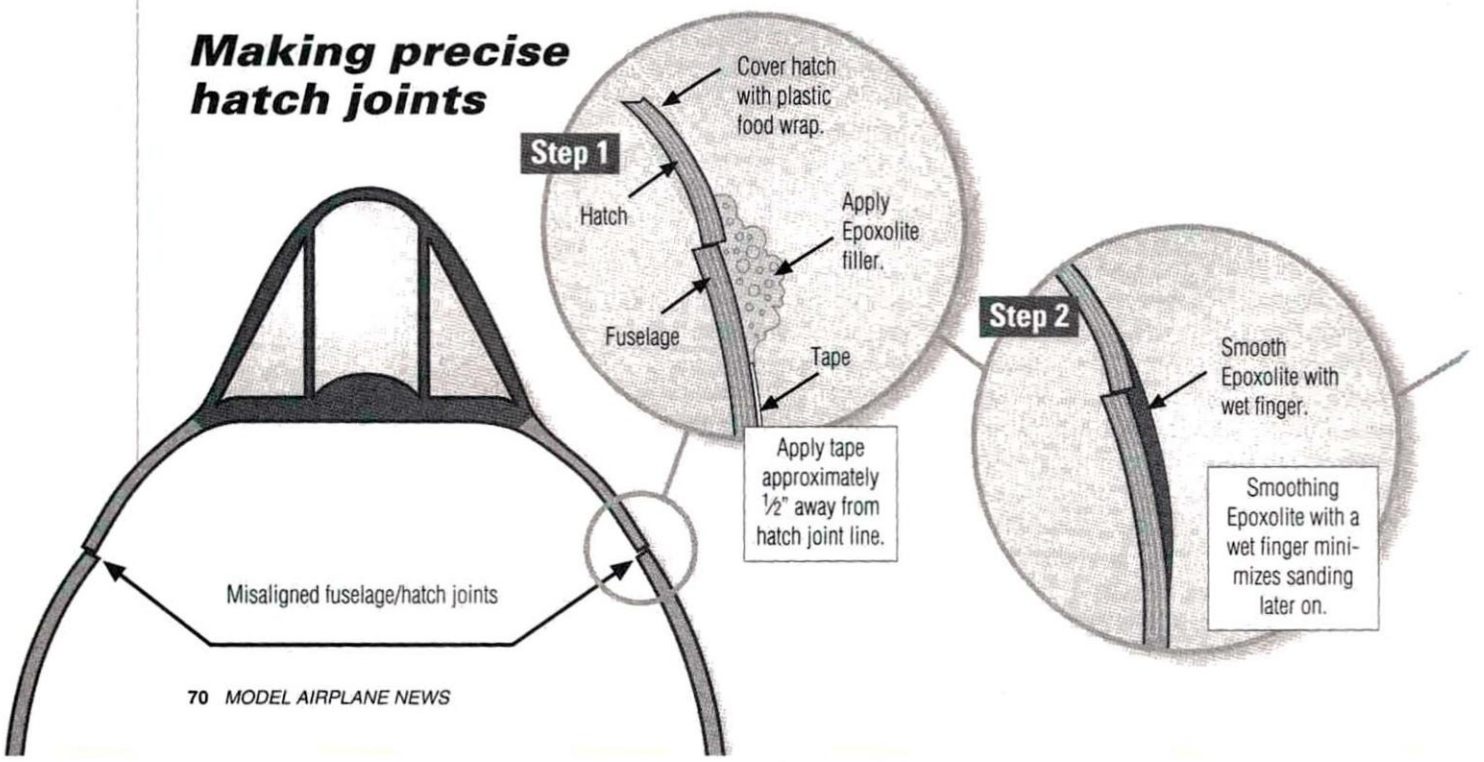
Two contestants I took note of this year were Jim Wilkinson and Stephan Durrstein. Jim's Focke Wolfe 190 A-8 and Stephan's Junkers Ju-52 are masterpieces of functional scale detail. Jim's 190 was built from Don Smith Plans* with modifications, including custom-built retracts, sliding canopy and functional tailwheel. Jim had not been able to fully weather the model prior to the contest but still received one of the highest static scores in Expert. An errant bomb drop cost Jim a higher placement.

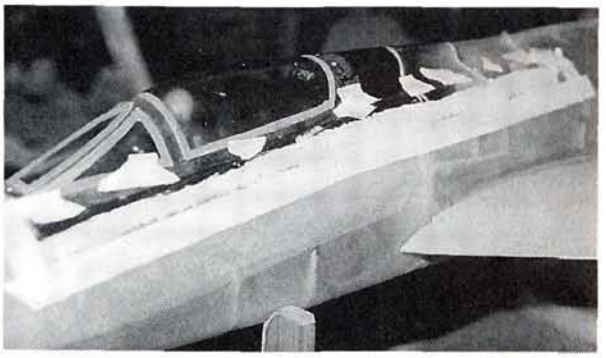
Frank Tiano teamed up with builder Bill Steffes to compete with this P-38 Lightning. Frank flew the Lightning to fourth place in Team Scale.

Stephan's Ju-52 trimotor is the prototype for a new kit from FiberClassics*. The striking red, white and black paint scheme was impressive considering the corrugations that covered almost every square inch of the model. His attention to detail and high level of craftsmanship earned him the second highest static score. When it was time to fly, however, Stephan was plagued with radio, engine and mechanical difficulties, and he hurt his model on its last landing. Stephen put in only one official flight, but the model did go back home to Germany in one piece. It must be a gigantic effort to bring a model and all your support equipment from as far away as Germany.

By the way, Frank Tiano, the promoter of Top Gun, has informed me that there are some openings for builders in the Team Scale class for 1998. If you drop Frank a note describing yourself and your plane (the events you have entered, etc.), you may be selected to participate next year.

Making precise hatch joints





Epoxolite has been applied and smoothed out with a wet finger.

BATES BOMBERS

Since I mentioned several months ago that I thought there weren't very many giant-scale bomber plans out there, I have been swamped with letters correcting my point of view. I now believe that there are exactly the right number of giant bomber plans out there to keep everyone in the entire universe happy! But then again, more would always be welcome.

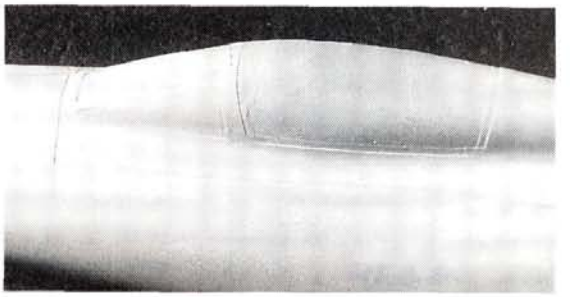
Fellow F-Trooper Jerry Bates recently teamed up with the venerable Art Johnson and is offering plans for Art's 1989 Masters-winning Martin B-26 bomber. With a wingspan of 106½ inches and designed for two Zenoah G-23s, the ⅛-scale B-26 is a real beauty. Retracts will be offered for the model by Century Jet Models*, and Jerry will soon have fiberglass cowls, vacuum-formed canopies and gun blisters for the B-26. Why not send a dollar to Jerry at 102 Glenwood St., Mobile, AL 36606, for his catalog and check out the neat products he has to offer.

PRECISE FIT

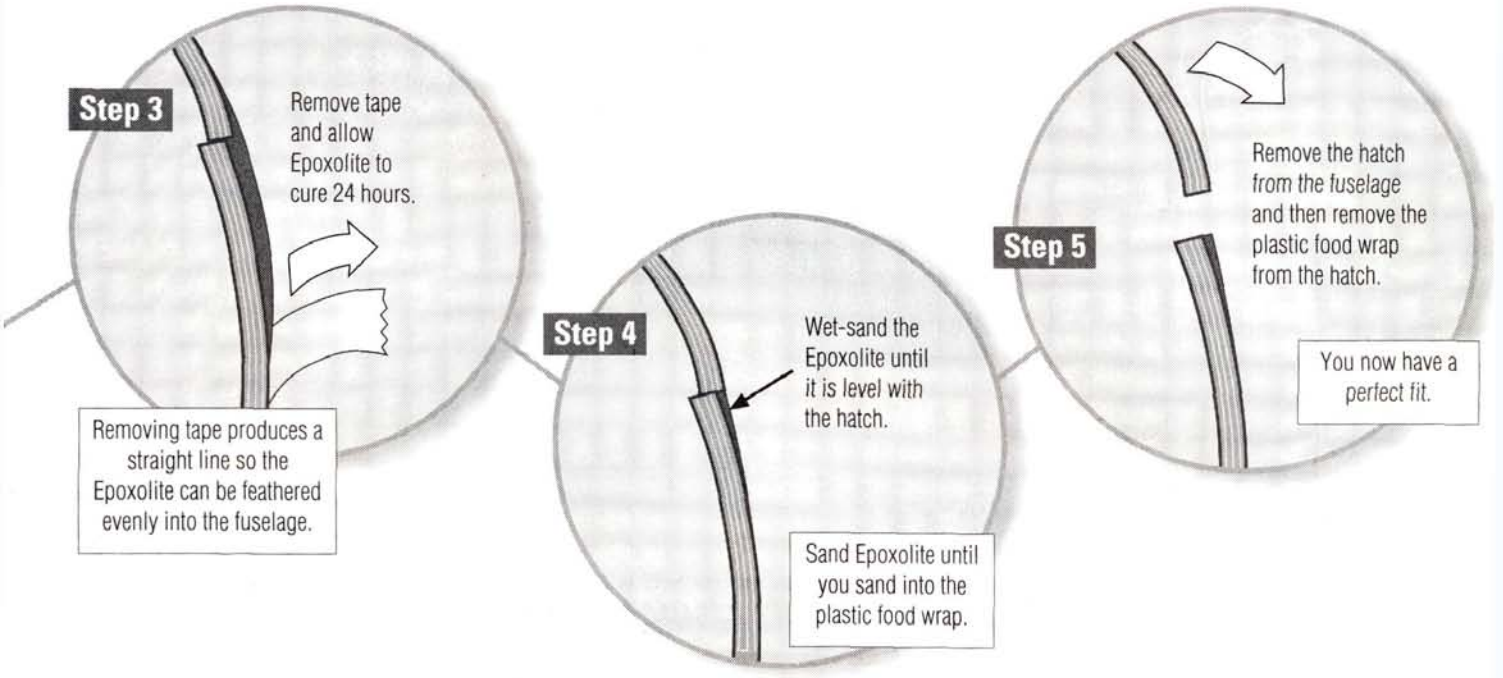
Having built several fiberglass and wood models, I know that perfect joints are not always achieved the first time you put parts together; fuselage hatches and wing-saddle joints come to mind. However, I find that minor flaws can be fixed with a simple technique using Sig* Epoxolite.

Epoxolite is an odorless, two-part sandable filler/putty material with good adhesive properties. It is also water-soluble, so clean-up is very easy. When properly mixed and applied to a surface, it can be shaped using your fingers or a smooth round tool with a little bit of water. This minimizes sanding when the material has cured (usually 24 hours). When you do sand it, make sure you wet-sand it with wet-and-dry sandpaper because Epoxolite does tend to gum up regular sandpaper.

If you have a hatch that does not fit your fuselage as well as you'd like, Epoxolite will do the trick. The trick is to build up the stationary surface of the fuselage so it meets the removable hatch to form a smooth and even joint line. Begin by masking off the area to be built up with one layer of tape. This tape will form a straight ridge of Epoxolite that we can feather into the fuselage when it has dried. Wrap the removable hatch with a clear-plastic food wrap. Pull the plastic wrap tightly along the edges of the hatch where it will come into contact with the fuselage. Make sure there are no wrinkles. Now place the hatch into position on the fuselage, and apply a liberal amount of Epoxolite to the joint area. Spread it between the tape and about ¼ inch over the plastic-wrap-covered edge of the hatch. Now, with a wet finger, smooth the Epoxolite into place following the contour of the fuselage

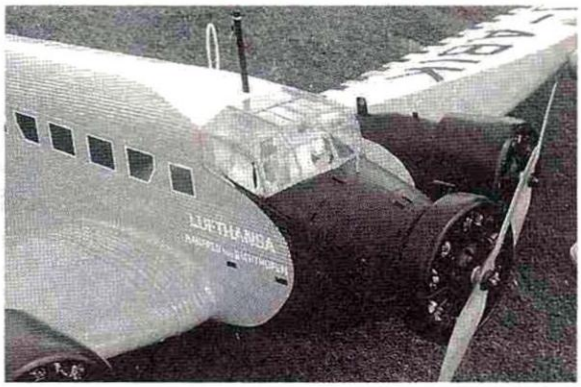


Here you see the finished hatch separation line after the model has been primed. Neat, eh?



and hatch. You may find that a plastic squeegee or an old business card works well to remove excess material. It does take time to become accustomed to the amount of water and finger pressure required to produce the desired results. But this will come with experience.

When you're satisfied with the results, wait at least one hour before removing the masking tape. At this point, the material will still be setting and a bit sticky, leaving a small lip as the tape is removed. Believe me, it is a lot easier to sand this lip than to try to remove the tape after the material has hardened over it. After 24 hours, the Epoxolite can be sanded (wet). Using a sanding block, sand the edge of the material until it feathers into the rest of the fuselage. Eventually you will sand the material down until you actually sand into the plastic wrap. When this happens, you'll be able to remove the hatch. Notice, by the way, how nice and smooth the separation line is between the hatch and the fuselage. If you aren't completely satisfied with the results, you can repeat the process until the joint is satisfactory.



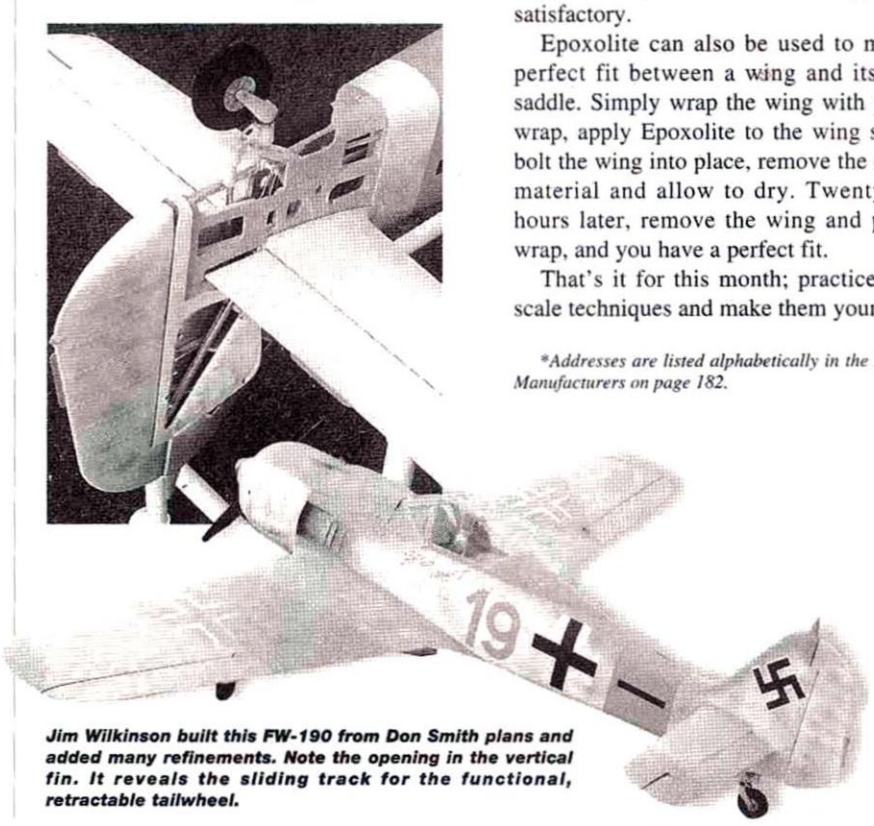
Stephan Durrstein's beautiful Junkers Ju-52 trimotor received the second highest score in Static at this year's Top Gun. The Ju-52 was damaged during a rough landing but did return home to Germany in one piece.

Winner of the new Top Gun Designer Scale class, Ramon Torres, built this Beechcraft T-42A twin. Here, the T-42A is just about to touch down.

Epoxolite can also be used to make a perfect fit between a wing and its wing saddle. Simply wrap the wing with plastic wrap, apply Epoxolite to the wing saddle, bolt the wing into place, remove the excess material and allow to dry. Twenty-four hours later, remove the wing and plastic wrap, and you have a perfect fit.

That's it for this month; practice those scale techniques and make them your own.

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*



Jim Wilkinson built this FW-190 from Don Smith plans and added many refinements. Note the opening in the vertical fin. It reveals the sliding track for the functional, retractable tailwheel.

by HAL deBOLT

CARL GOLDBERG'S LEGACY

Carl Goldberg shows off the Senior Falcon at a Toledo show.

Model aircraft have been around since the 1800s, but model aviation as we know it was born in the time of Lindbergh—70 years ago. Rubber bands were the only viable power for models for the first few years, until Bill Brown's gas engine in '32 opened the door to what we have today. Most of the R/C old-timers came from those early days, and a short biography of one of the most prominent should interest you.

Model Airplane News *mentor, Walt Schroder, considers Carl's twin design.*

Carl Goldberg, a gentleman's gentleman, master model designer and builder, industry giant and friend to all modelers, left us all too soon. If you, as a modeler, had been introduced to Carl, you would have immediately felt that you had a friend! From very early on, modeling became Carl's life, and he embraced all of it and us to the end.

Carl came to prominence in the early '30s when he became king of the indoor flyers. His national records were exemplary! Remember that in rubber-only days, active modelers would usually compete in both outdoor and indoor events. Carl specialized in indoor and was widely recognized as a leader.

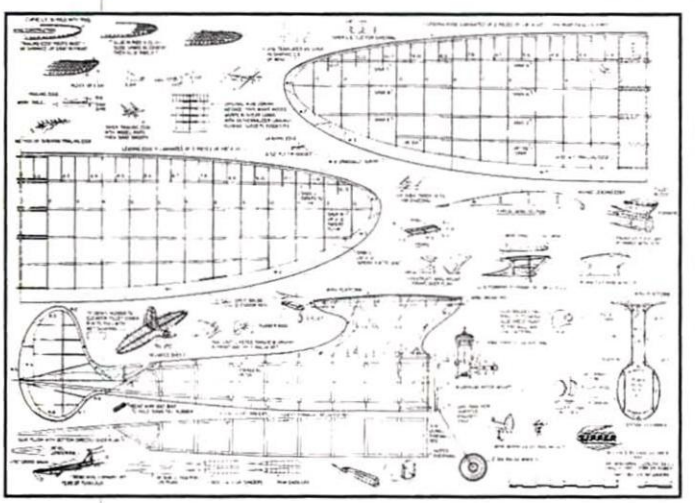
In the early days of model aviation, the Comet Model Co. was a major supplier of a wide range of small, rubber-powered kits. They made stick-and-tissue kits for most WW I fighters and almost all else, including Baby R.O.G. stick models. Happily forgotten is the fact that the ribs and formers were printed on balsa; you had to "die cut" them yourself using a razor blade!

Carl lived and breathed model aircraft. With his reputation, he found employment as a designer with Comet. It is assumed that his initial efforts were with the established line of models.

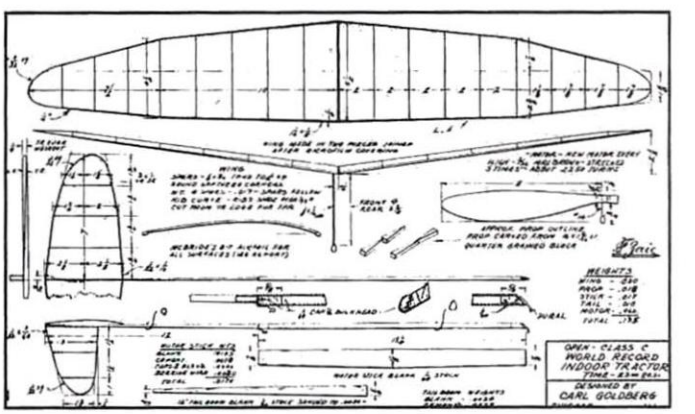
When Bill Brown introduced the gas engine, it took some time for us to save our nickels to buy one. In spite of that wait, there were still no plans—much less kits—for gas models. You had to make your own!

I suspect that Carl was in a similar boat; his answer was the eye-opening Valkyrie—probably the most beautiful free-flight model ever. This 10-foot-span beauty had a "round planked" fuselage topped by pretty elliptical surfaces, and it had more than 1,100 square inches of wing area! It was a flight gem from the start. It's a pity Carl never got to

(Continued on page 126)



Left: Carl's Comet Zipper ruled free flight for many years. Below: Goldberg's world-record indoor stick model (Zaic).



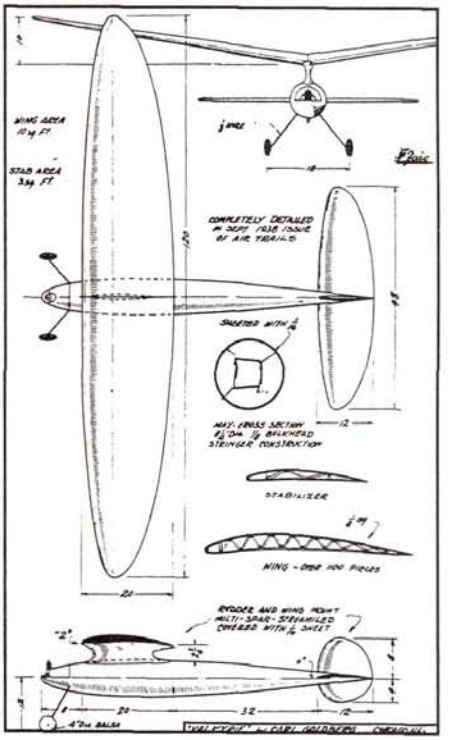
Golden AGE OF R/C

(Continued from page 124)

enjoy it much; it was lost out of sight on its third flight! Oh, for R/C!

Comet had a desire to expand beyond their 10- to 50-cent kits. With Carl at the drawing board, they had the right man for the job. Early on, gas models were at the pinnacle that R/C enjoys today; they were the "big ticket" products. Great; let's have some of that! The decision led to the greatest upheaval free-flight modeling has ever seen, and Carl was the instigator.

At the time, free-flight designs tended to be cabin or shoulder-wing models. They gained altitude in wide circling climbs and were very sensitive to power; spiral dives were common! Something was needed to control the power and allow a more rapid climb.



Carl's fabulous early free-flight Valkyrie (Zaic).

Well-thought-out in every respect, from accessibility to structure and aerodynamics, Carl's Zipper design easily absorbed the power. It had a vertical spiral climb with turns so tight that they might be labeled vertical rolls today.

Needless to say, we know that the user-friendly Zipper dominated free-flight for years and put Comet solidly into the gas model business. Carl's success continued with ongoing winners such as the Mercury, Sailplane and Interceptor, and for decades, he established free-flight longevity records in national competitions.

1/4 MIDGET PYLON RACING

One good thing about writing this column is that when I ask for help, there is usually a fine response. This time, it was great to have OT R/C'er and *RCM* columnist Chuck Cunningham fill us in on the beginning of 1/4 Midget racing. Thanks, Chuck.

As pylon racing grew, the competition took the various phases of it to higher and higher levels—often, to more than the average modeler was interested in. Because it is necessary to attract newcomers to our hobby, various new events were tried as incentives, and 1/4 Midget was one of them.

Old-timer Don Dewey has always kept his eye on our needs. In 1968, Don contacted Chuck Cunningham with an idea for a pylon event for newcomers that would allow them to use a small, inexpensive engine, omit the finish requirement and pattern after any full-scale racer. This could be the incentive for anyone to try R/C racing. Chuck and his Ft. Worth-Dallas cohorts put together some fundamental rules tailored to .15 engines. When Chuck published the rules in his column, the reaction was encouraging.

This 1/4 Midget Caudron was assembled from a Live Wire kit and is powered by a Cox .15.

The event caught on with Chuck's group, and a number of exploratory races were conducted at the Ft. Worth Thunderbird field. Initially, the simple O.S. .15 engine was used, and some fine races occurred; it seemed to be just what the average modeler would like, and—best of all—could afford. The NMPRA approved 1/4 Midget, and soon it was an official AMA event. The rules called for a .15 engine with idle ability, 300 square inches of wing area and a minimum weight of 2½ pounds. The course was 10 laps for 1½ miles.

Racers who had in-line engines made sleek 1/4 Midget racers; this one is a Shoenfeld Firecracker.

For a time, 1/4 Midget seemed to be the ticket; however, whenever the word "racing" is mentioned, contestants try to win, and serious pilots look for ways to go faster. The easiest answer is more power, and soon the O.S. sport engine was outrun by the SuperTigre and the Rossi .15. America's pride produced the Cox Conquest .15, which ruled supreme for many moons.

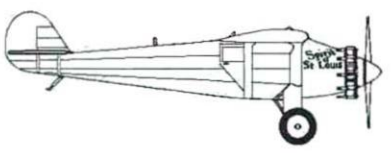
As so often happens, what started as a simple idea became sophisticated, and Don Dewey's original objective was lost in the shuffle.

Today, we have the Q40 event with similar objectives. Will its purpose be changed, too?

Apparently wanting more, Carl left Comet to establish his Carl Goldberg Model Co. Is there any modeler who has not built a CG kit?

When control line took over, Carl went into that market with several successful, innovative kits. However, CG didn't really make its mark until R/C arrived. When the Live Wire's success demonstrated the viability of R/C, others were quick to join. Carl came aboard with a sleek, .60-powered shoulder-wing model called the Senior Falcon. Its acceptance led to the Jr. Falcon, which was by far the most popular early CG R/C kit. Although Carl was never a prominent R/C flyer, the Falcon models established him and CG as one of R/C's early birds.

Of course, the Carl Goldberg Model Co. thrives today and has continuously offered fine, attractive kits that so many R/C'ers enjoy. We lost a great modeler, friend to all model aviators and an astute businessman when Carl passed away. That his influence is apparent in so many of today's great models is a tribute to him.



by JIM RYAN

CAD DRAWING: IT STARTS WITH A 3-VIEW

ONE OF THE most helpful modeling applications of the home computer is using CAD (computer-aided drawing) to design aircraft. CAD has revolutionized the design process; no matter how large your project is, it can be drawn at a scale of one to one, and if you decide to change the overall size or proportions of the airframe, that can be accomplished with a few keystrokes. Although the same mental processes apply, using CAD is very different from sitting at a drafting table, and noted designers such as Martin Irvine and Nick Ziroli Sr. still design their creations with pencil and T-square, simply because they enjoy doing so. But for me, the advantages of CAD far outweigh the enjoyment of working at the drawing table, and I use CAD exclusively.

There are any number of CAD programs on the market these days, and I'm not going to debate their relative merits here; as with religions and operating systems, there's no accounting for personal tastes. I use AutoCAD LT because I learned it nearly 10 years ago, I use it regularly for my work, and it's the *lingua franca* of the engineering world. There are certainly less expensive programs on the market, all the way down to perfectly usable shareware demo programs that you can download from the Internet. I recommend that you shop around, find one you like and stick to it; trying to use several different CAD programs is like trying to learn three foreign languages at once.

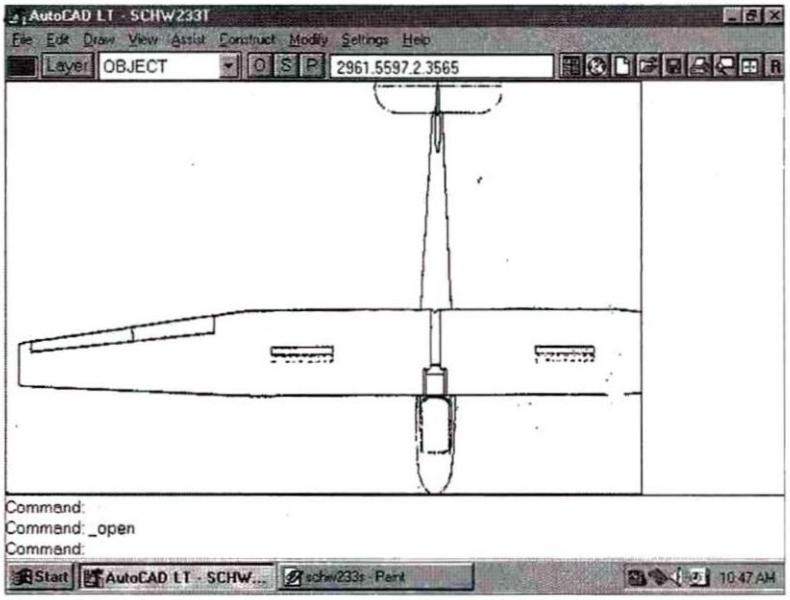


Figure 1. Here's how a 3-view for a Schweitzer 2-33 sailplane looks once it has been converted and imported into AutoCAD. Note the rough, fax-like picture quality. Next, switch to a new drawing layer and trace over the image.

Many of you will use CAD for designing entirely original aircraft, but for the present discussion, we'll assume you're designing a scale model. This brings up a problem: how to get your 3-view from paper to computer screen. In the coming months, I'll discuss three methods, each of which requires a different approach and different hardware, from fairly expensive peripherals to basic tools you probably already own. The degree of accuracy you'll apply will vary depending on whether you're designing a sport-scale model for your own enjoyment or a Top Gun masterpiece, but the basics are the same in either case.

USING SCANNED IMAGES

The first method begins with a scanner. More and more people are buying scanners for their home computers, because scanners make it quick and easy to load documents, drawings, photographs and other visual media into your computer. This seems a natural solution to our problem of getting the 3-view into your CAD program, but there are a couple of issues to address first. Of necessity, some of this information will overlap with Bill Griggs' "Cybernews" column from the March '97 issue of *Model Airplane News*. If you're interested in dedicated scanning programs, that column is worth another read.

• **Cost.** Scanners range from about $200 to well over $1,000 for a really sophisticated unit. This is fine if you already own one, or want it for other uses, but it's hard to justify the

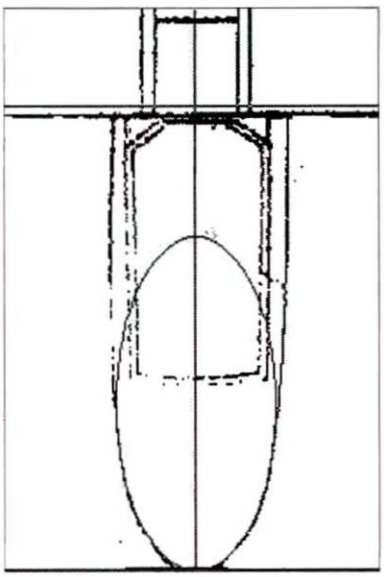


Figure 2. Here, I've zoomed in close to trace the nose outline; the low resolution of the scanned image is apparent. Note how closely the ellipse I've just drawn matches the outline. I rely heavily on lines, arcs, circles and ellipses for drawing 3-views and resort to more complex tools like polylines only when necessary.

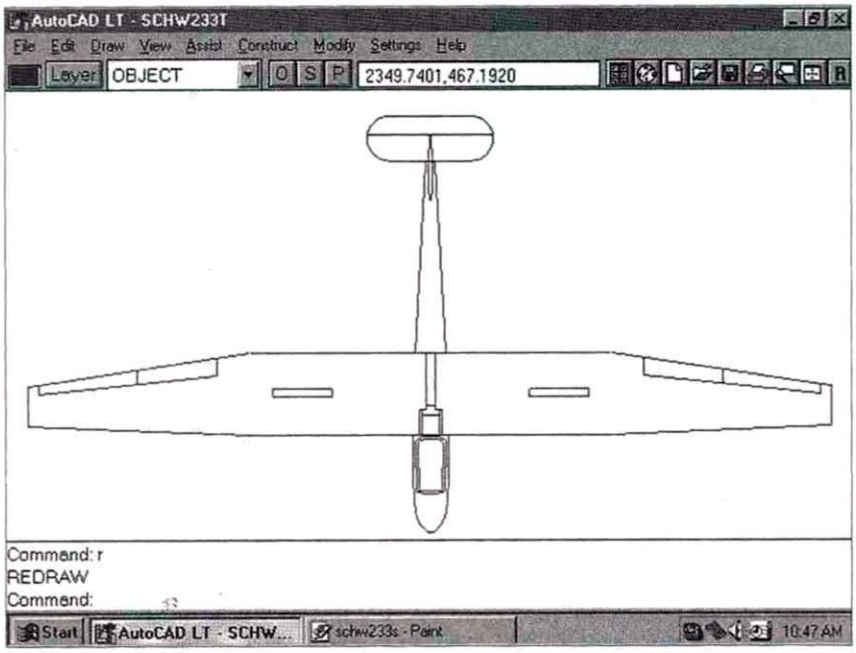


Figure 3. Here's the finished top view after I had erased the scanned layer. Because the top view is symmetrical, I trace only one side and then copy it using the "mirror" command. I'm now ready to go on to the side view.

expense solely for designing airplanes. I don't own a scanner, in part because my notebook computer is already bursting at the seams. I have access to scanned images when I need them, and most of you probably have an accommodating friend or a local service that will scan images for you.

• **Conversion.** I promised to stay away from computer jargon in this column, but before we can continue, it's important to understand a distinction in the various ways that visual images are stored on your computer. The files created by a scanner are examples of *raster* images; the scanner divides the image into a grid, and each grid position, or "pixel," is filled with either black or white (or a color, in the case of color images). (Fax machines work on this same principle; this is why faxed drawings are of a somewhat lower resolution than originals.) A CAD program, on the other hand, uses *vector* images. This means that each line in the drawing is a line segment or arc that travels from point A to point B, just like in the Cartesian coordinate problems you did in high school geometry class. This is what makes it possible to scale a CAD drawing to any size without losing resolution; the line is not a line, but rather a mathematical representation. So the main problem is that before your scanned image can be of any use to your CAD program, you have to convert the raster file to a vector file.

There are a number of different raster file formats, including TIF, GIF, JPEG and bitmaps; but most scanners can also create "PCX" or "pixel" files. Also, many graphics viewers can convert raster files from one of these types to another; this can come in handy if you want to work with a file that someone else scanned for you. For their part, the various CAD programs also have a wide range of native drawing file formats, few if any of which are mutually compatible, so the people at AutoDesk created a universal drawing file format called "DXF," or "drawing exchange format" that could be used to import a drawing from one CAD program to another. DXF isn't a perfect methodology, and it's not uncommon to get minor glitches when attempting to import a DXF file. But it's the only game in town, and we use the tools we're given. Since nearly any decent CAD program is capable of importing and exporting DXF files (this should be on your list of priorities when shopping for a CAD program), your only remaining problem is how to convert the PCX raster image to a DXF vector file.

Since this is a common dilemma, some enterprising developers set out to solve the problem by writing simple programs that automatically convert PCX files to DXF files. PCX to DXF converters work reasonably well, but there are some caveats: because they work by converting the dots that make up the raster image into very short line segments, the resulting file is very large (a megabyte or larger isn't unusual). This makes them slow to load, but more

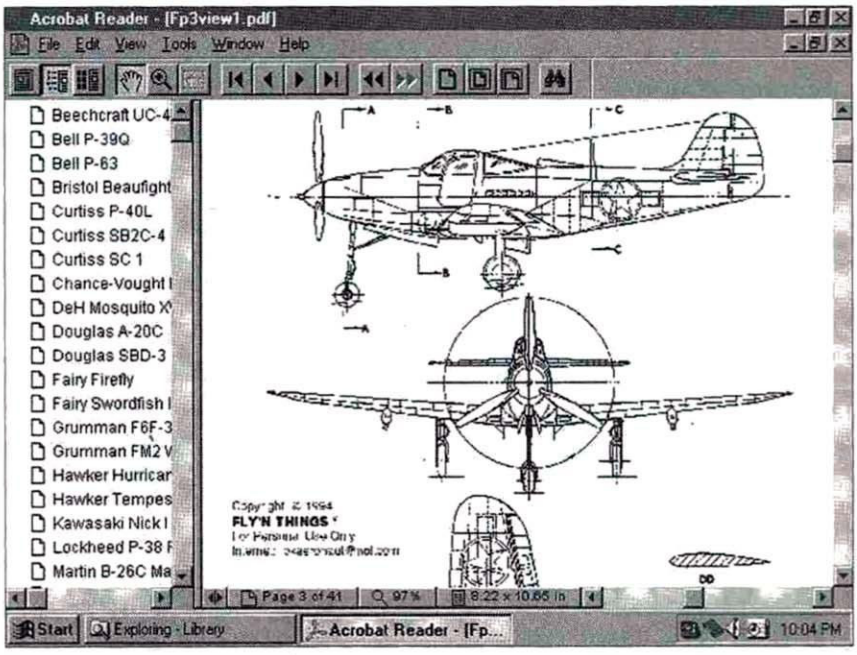


Figure 4. An Internet search will uncover dozens of websites with 3-view libraries. One of the better ones is the PKAeronaut Aircraft site (http://users.aol.com/pkaeronaut/pkaacrft.htm), with over 500 3-views available in a zipped .PDF archive. You can select the 3-view of your choice from the .PDF catalogue and then download the corresponding .PCX file for a nominal fee.

important, this means they're really only useful as a guide that can be traced over to get the actual vector drawing that will be the basis for your plans. In between, you'll likely need to erase a lot of extraneous detail on the 3-view, like rivets, panel lines and notes that aren't needed on your plans. The only features you want to retain are the scale outlines, fuselage sections and any important auxiliary views. Once you have your CAD 3-view completed, you can erase the layer containing the scanned image and then scale the entire drawing to the correct size of your model before proceeding with the structural design work.

The best converter I've found so far is Fly'N Things' PCX to DXF Conversion, a Windows-based shareware program that can be downloaded from **http://www.winsite.com/info/pc/win3/misc/pcxtodxf.zip/.** If you use an older platform, the "PCX Scan Line Translator" is a DOS-based converter available for download at **http://www.vmedia.com/commodity/onlinecompanions/autocad/software.html.**

In his March '97 column, Bill talked about Windsoft's Scanover, a program that can be used to display a raster image as a transparent layer in your CAD program so that you can scan over it. This is a very workable approach, but it requires specialized software, and you must have the dedicated version for your particular CAD program.

The point is, although you can convert scanned images to CAD drawings, it's far from an automatic process. To get from paper 3-view to computer 3-view, you need to follow these general steps:

1. Scan image to create PCX file.
2. Use converter program to convert PCX file to DXF file.
3. Import DXF file into CAD program and save in native drawing format.
4. Erase extraneous details.
5. Trace over short-line segments of converted file with long lines, arcs, ellipses and polylines, preferably on a different drawing layer.
6. Erase layer with scanned lines.
7. Scale 3-view to actual size of model and save file.

Many users find this an easy and practical way of getting a 3-view into their CAD program, especially if they already own the hardware. I prefer to use one of two other techniques, which I'll tell you about next time.

MODEL AIRPLANE NEWS
PRODUCT REVIEW

Fighters for your VCR

AMR Production Videos

GIANT-SCALE WARBIRDS

by GERRY YARRISH

Warbirds—IMAA-legal warbirds—are becoming one of the most popular groups of giant-scale models being built today. It seems every year there's a new "Warbirds over Somewhere" rally being put together by modelers bitten by the warbird bug. AMR Productions has put many of these popular events on tape in a way that minimizes your "fast forward" mode of viewing. Produced by Mike Roselli, AMR videos are worth your consideration.

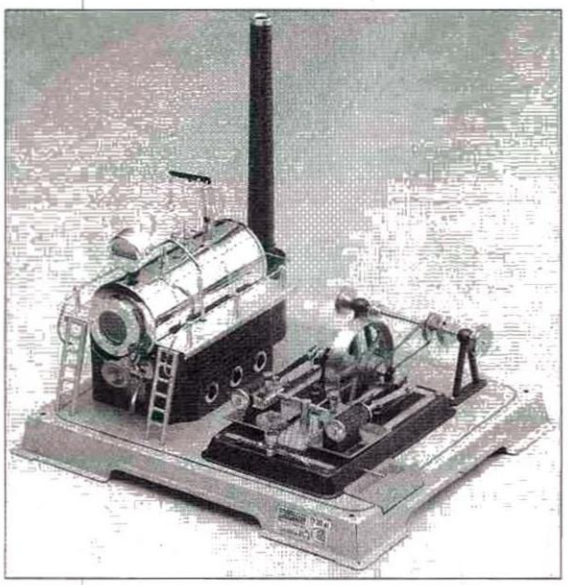
Mike travels to most warbird meets up and down the East Coast and has come to know most of the pilots at these gatherings personally. In so doing, Mike's videos are both informative and varied in their content. The viewer is presented with close-up details as well as flight sequences that show these warbirds at their best. Interviews with notable modelers give you insight to their passion for warbirds and details of how their models were built. Period music, subtitles and a fair amount of editing show that Mike is trying to present the best video he can produce. The three videos shown above, "Thunder in the Sky," "Warbirds '96'" and "Birds of Prey #2," highlight such aircraft as the Ziroli P-38 Lightning, Skyraider, Stuka, C-47 and Stearman PT-17, Byron Originals P-51 Mustangs, P-40s and Corsairs, a Yellow Aircraft AT-6 Texan and Spitfire and many unique scratch-built fighters from Bob Holman and Meister Scale plans, to name a few. Whether you fly giant-scale warbirds or just like to dream about flying them, AMR videos are fun to watch over and over again. +

Air POWER

by CHRIS CHIANELLI

OIL CONTENT —THE RIGHT TO KNOW

When I was about eight, I asked my father for a steam engine for Christmas. "I'm sorry; you'll have to wait until you're a bit older for live steam, son," he answered. One day, he came into my bedroom and exclaimed, "What is that?!" It was a boiler I had built out of an empty acetylene cylinder laid over and cemented to four fire bricks. The



smokestack was fashioned from copper sheet, and the whole thing was set on a base made of a slate slab and a Hoffmann soda crate. Obviously, I was a kid "driven" by engines. I received a lengthy lecture with a few "Are you completely out of your mind?!" thrown in. But, there was a glorious upside. Shortly afterward, my Dad did buy me a little Wilesco static steam engine from Germany—complete with a double-acting, reversible cylinder and reciprocating valve system. Music played in my little 9-year old head. Trust me; it was visions of our white colonial house surrounded by red pumper trucks dowsing 50-foot flames raging from every window that motivated my Dad. Who cared?

Ultimately, my little steam engine was a reality, and I was mesmerized. I watched its miniature puffing and clattering for hours on end—first in one direction, then in the other. Totally riveted. Whenever my older sister and I argued about what to watch on TV, my Mom would quickly produce some of the dry-spirit tablets—the fuel on which my engine was fired. Brother/sister hostilities ceased instantaneously because I was out the back door to run my engine (Kissinger had nothing on my Mom). Indoor running was strictly verboten. Even in winter, I willingly froze my little butt off. The point is that from then on, I've always loved engines, be they gas, glow diesel, rotary, radial, migrating combustion chamber, turbine, Wankel, 2-stroke, or 4-stroke.

Over the years, however, I developed an equal love of R/C airplanes, and I do realize that many of you who share this love don't necessarily share my passion for engines. I understand that, to many of you, the metallic necessity that hangs on the nose of your model is nothing more than a means by which to get your model to altitude—reliably! OK; to me it's a living, breathing work of art in multiple polished alloys working in harmony. If you don't share this view, well, that's my problem.

Apropos of the aforementioned, my intent in this column is to address the "flight-line" realities of hassle-free engine running, not to deliver empirical data from the laboratory or podium. From time to time, I will include mini engine reports, the results of which I'll discuss in terms of their practical applications and how they relate to the various types of designs we modelers fly; but I will also address everything and anything related to model airplane engines as well. Things such as fuel, engine mounts, glow plugs, on-board igniter and ignition systems, pumps, fuel filters, after-run care and oils; you name it! And I mean that literally; I want you to "name it" by snail-mail or email. If there's a product or an engine (new or old) you want to know about before making a purchase, please let me know! I will respond. Write to me at 100 East Ridge, Ridgefield, CT 06877-4606, or chrisc@airage.com.

DON'T FUEL AROUND!

I'd like to start this column off with a bang, and I can't think of a more "explosive" topic than fuel. Though it's true that our alcohol engines have cooling fins and are air-cooled, I always think of them as being liquid-cooled. This thinking keeps me in the "Run it rich, stupid" frame of mind. The stuff that spews out of the exhaust pipe (oil and unburned alcohol) dissipates tremendous amounts of heat. The fuel in an alcohol/glow system powers the engine, lubricates the engine and cools the engine. What could be more important? Obviously, fuel choice is important and should be approached accordingly. If price, for example, is your sole criterion, trust me: in the long run, you'll

Wildcat®, a fuel company that has already made quite a name for itself, posts oil type and volume content by percentage on every bottle of fuel it manufactures.

Byron Originals* has also begun to post oil type and volume content by percentage on some of the fuels they manufacture.

spend much more than you bargained for.

My feelings on the subject are simple: if an engine manufacturer recommends a certain volume of lubricant for an engine, stick to it religiously. O.S.* and Thunder Tiger* recommend no less than 18-percent-lubricant fuel, and Enya* specifies 20 percent for break in and 15 percent for running. Don't let any self-anointed "expert" talk you into second-guessing the designers of these engines. The factory guys *know* what they're talking about. Moreover, some excellent warranties are offered today—far better than ever before. Do your part to protect them. Remem-ber this: the manufacturers back your warranty and have the option to honor or void it as they see fit. So who do you think you should listen to?—your engine's manufacturer, or big-mouth Joe "know-it-all-about-everything"?

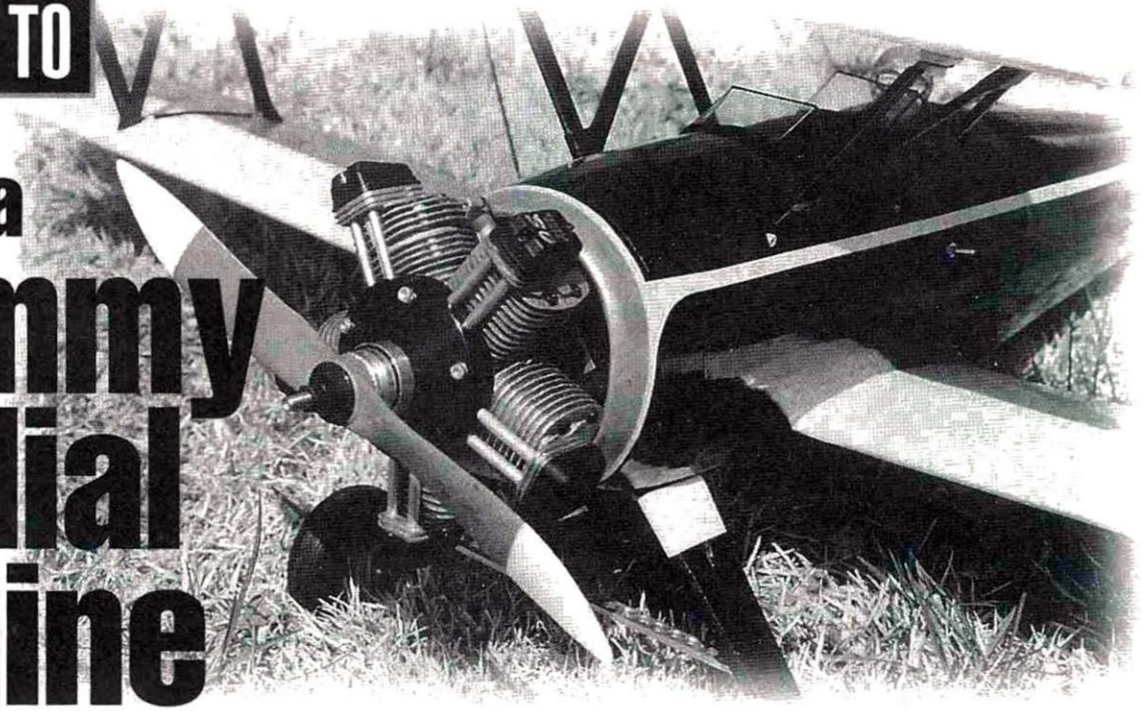
Furthermore, I would use only fuels by manufacturers that tell you on the product label the lubrication's exact volume by percentage. Some prefer to keep the percentage a secret. Why do they do this? Do they think that YOU CAN'T HANDLE THE TRUTH??!! Don't let anybody tell you it's an "industry secret." If they want to keep it a secret, let them keep their fuel. With prices as they are these days, you don't want the "mystery blend" to pass through your expensive engine. You want peace of mind. You want to know that you're complying with manufacturer's specs and that your precision powerhouse is properly protected! Even if you aren't "pistons possessed" as I am, proper engine care is every bit as important to you. Think about it: how many beautiful models have we seen destroyed by a boulder or rusty old Chevy Vega hiding in the tall grass just a few 100 yards out from the landing strip because an engine went dead-stick?

Yes, there are many reasons an engine can quit. But this much is certain: there's no long-term dependability without proper care; and proper care starts with good fuel containing recommended oil content.

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.* ✦

MODEL AIRPLANE NEWS
HOW TO

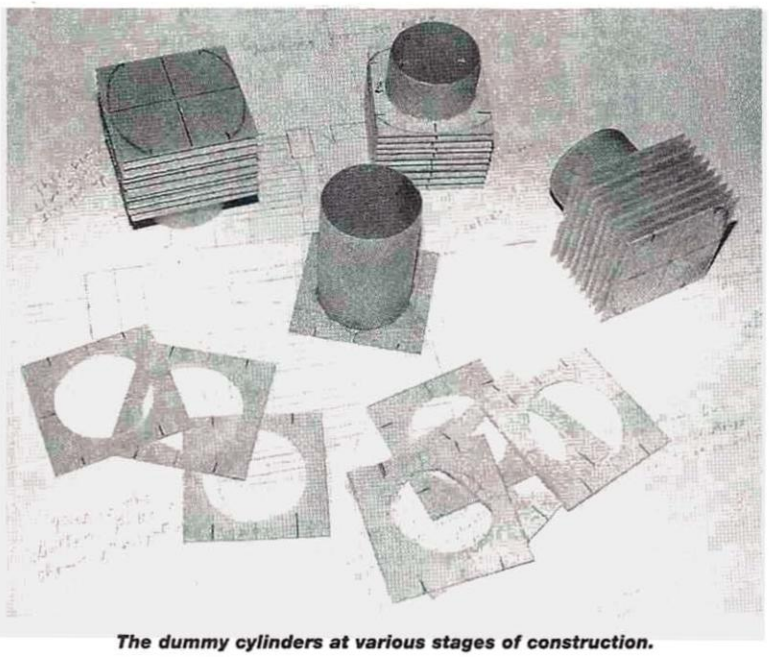
Make a Dummy Radial Engine



by BUD GEWINNER

Disguise your glow powerplant

THE STEARMAN PT-17 IS A CLASSIC biplane that should be modeled often, but you've got that big problem of a radial engine staring you right in the face. When I decided to build a 50-inch-span Stearman, I knew I couldn't hang a single, naked cylinder on its front end. I could, of course, have put a cowl on the model and called it a "Super," but then it wouldn't have been a Stearman PT-17. I could have bought a radial engine, but even forgetting about the cost, that isn't really the answer for a moderately sized model. I knew I had to produce four dummy cylinders that realistically matched my O.S.* .52 Surpass 4-stroke. I've flown this model for a full summer, and engine vibration hasn't damaged the dummy assembly.



The dummy cylinders at various stages of construction.

INTERIOR CYLINDERS

All dimensions given here are for the .52 Surpass, but you can easily determine the correct dimensions if you're using a different engine. Start by making the dummy cylinder's interior tubes. Cut four pieces of 94x40mm, 1/64-inch-thick ply with the grain parallel to the short side so the plywood will bend more easily. Soak the pieces in boiling water for 15 to 20 minutes, then bend them around a 1 1/8-inch-diameter wooden dowel. Wrap them tightly with an elastic bandage. The next day, glue their edges together to form four tubes. This isn't easy, but if you wrap some wax paper around a 1-inch-diameter dowel and put it in a vise, you can hold the bent ply while you tack it in a few places with medium CA. Then, hold the cylinder down on a sheet of wax paper and run a full bead of CA down its length. Don't worry if the tube isn't perfectly round; it will be forced into round when you slip the fins on later.

"COOLING" FINS

Now make the fins: use 36, 42x40mm pieces of 1/32-inch-thick ply. Draw a 1-inch circle in the centers of four of the fins and cement a tube in the center of each. Use a 1-inch circle cutter on a drill press to cut a circle in each of the remaining 32 fins. (If you don't have a drill press or a 1-inch circle cutter, sand the centers out using a Dremel.) Then, sand the holes until the fins just slip onto the tubes,

which are about 1 3/16 inch in diameter. You're now ready to cement the fins onto the tubes. Just set the tube down on its top fin, slip a fin down on the tube and tack it with medium CA. Use scrap 3/32-inch brass as spacers so the fins are evenly spaced. Each dummy cylinder should have nine fins on it. Don't worry if the holes in the fins aren't perfectly round and there are gaps between the fins and the tube; you won't notice these in the completed engine.

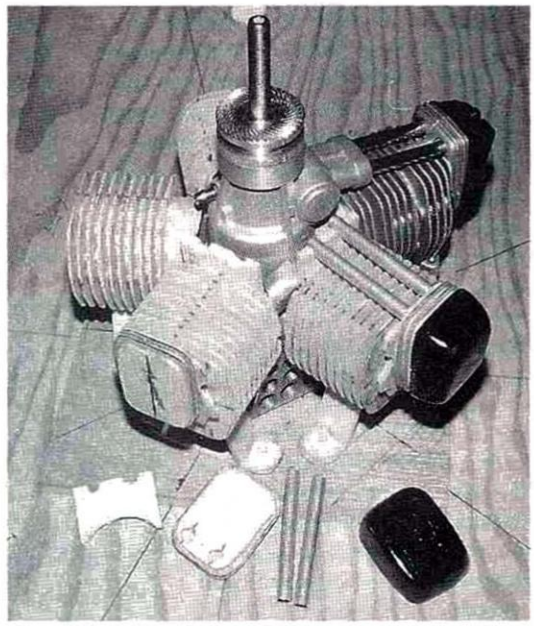
The dummy cylinders now have to be sanded so that the fins have rounded corners. Just look at the fins of your engine and try to duplicate their shape.

Here are one of the blocked-up cylinders and the brass strip that I used as a guide. An A-frame support is also shown. You can also see how the inner end of the 1/64-inch-diameter tube is cut away to clear all parts of the engine and engine mounts.

DUMMY CYLINDERS

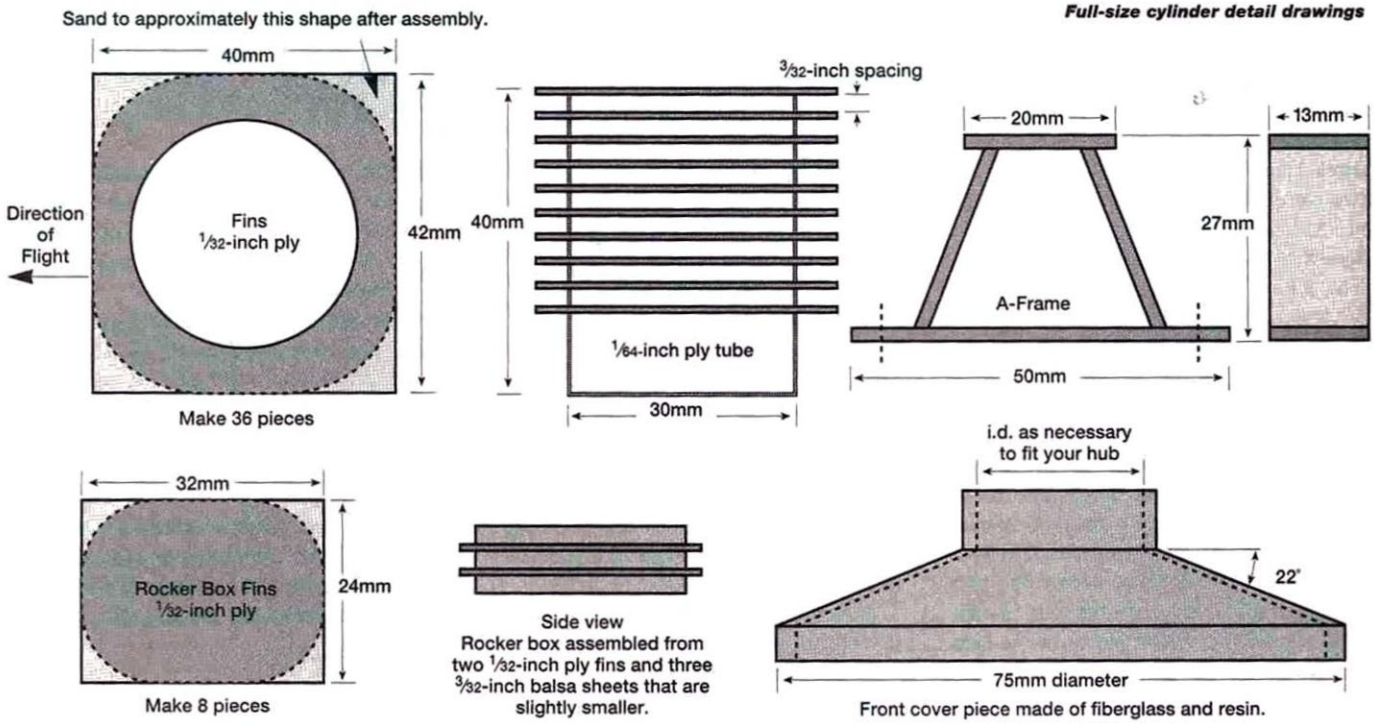
Now you're ready to assemble the cylinders. First, build the firewall that you will actually use in your plane. I used 5mm-thick, 5x5-inch-square lauan plywood that I later trimmed to a 5-inch-diameter circle. Drill 1/8-inch holes in the center of the firewall and in a large board, then slip in an 1/8-inch-diameter dowel to keep them together. Then, draw lines radiating from the center of the engine; these represent the center line of each cylinder. For a 5-cylinder radial, those lines would be 72 degrees apart. Mount your engine to the firewall and place it back on the board (you'll have to drill holes in the big board to allow the bolts of the engine mounts to pass through). Don't use an oversize mount because it might interfere with the wood cylinders. I used Sig* aluminum mounts (drilled to reduce weight) because they're nice and compact.

Each dummy cylinder will be glued to an A-frame that's bolted to the firewall. To determine the proper height of the A-frames, take one of the dummy cylinders, place it in position and block it up until its height matches your engine's "live" cylinder. I made a simple metal guide that I placed over the crankshaft, and with the plug out of the engine I rotated it from the engine to the dummy cylinder. Now make four A-frames, as shown in the drawing. Make sure that the dummy cylinder clears all parts of the engine, and engine mount by about 1/8 inch, so the engine doesn't touch anything when it runs. Don't worry how this inner area looks; after the crankcase cover is put on, you won't see it.



One of the fully finished cylinders and the valve cover, the aluminum tubes, the rocker box and the balsa support for the inner end of the aluminum tubes.

Full-size cylinder detail drawings

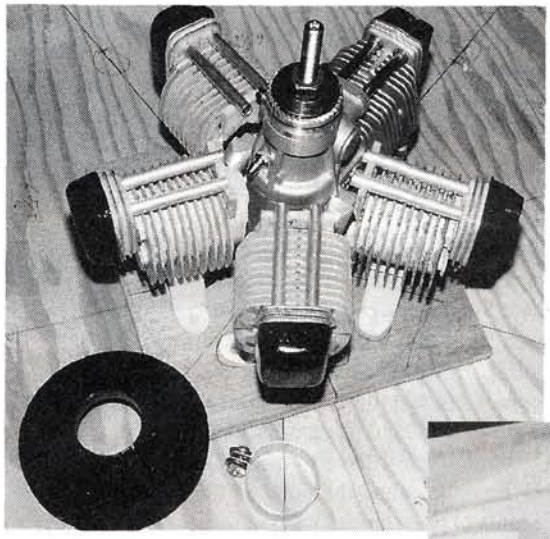


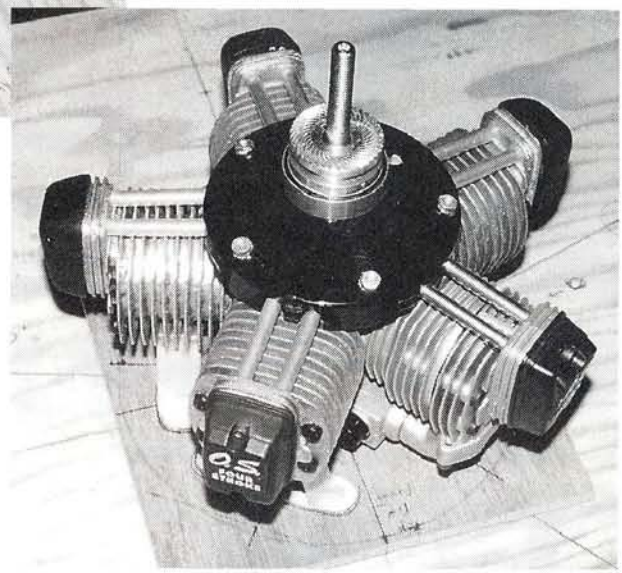
Fasten the A-frame supports to the firewall. Place the A-frames on the firewall so that they straddle the 72-degree lines, and set them so they are about 3/8 inch away from the outer diameter of the firewall. Later, you'll have room to glue a balsa lip onto the firewall; this will make the engine look "built in." When the A-frames are in place, transfer the hole positions to the firewall and drill and tap for 4-40 nylon bolts. Now bolt all four A-frames to the firewall and fit each dummy cylinder by sanding away as much of the 1/64-inch plywood end as necessary; the outer fin of each cylinder should extend to the same point as the outer fin of the engine. The metal pointer can be rotated to each cylinder to determine if each is positioned correctly.

You're now ready to cement each cylinder to its support. This requires some care to get each cylinder lined up properly on its radius line. Use 5-minute epoxy on the top of the A-frame, then set the cylinder on the support and quickly make sure it's lined up in the proper direction and that the top fin is the proper distance out. When the 5-minute epoxy has set, go to the next cylinder, but don't try to do them all at once; you don't want to "nudge" the previous cylinder when you start to work on the next one.

VALVE TRAIN

Now you are ready to set up the valve train. You'll have to make the valve cover, the aluminum tubes, the rocker box and the balsa support for the inner end of the aluminum tubes. Measure the rocker box that sits on the top fin. (The .52 Surpass measures 32x24mm.) To make these units, use two pieces of 1/32-inch ply with three pieces of 3/32-inch balsa that are slightly smaller. Sandwich the pieces together and glue them. You'll have to drill 3/16-inch-deep holes in the bottom of these rocker boxes to accept the two pushrod tubes, which you'll make out of 3/16-inch aluminum tubes. Glue these rocker boxes to the top of each cylinder and be certain that the holes are in the proper position for the aluminum tubes. The support for the pushrod tubes at the inner end of each cylinder is simply a piece of 1/8-inch balsa glued to the bottom fin. Cut two notches into the balsa to accept the two aluminum tubes. To make the four 1/8-inch balsa supports, cut eight pieces of 3/16-inch aluminum tube of the length needed to go from the rocker box to a little beyond the bottom fin where the balsa support will be. The height of the balsa pieces should be determined by test-fitting the aluminum tubes so their height is the same as those of the real cylinder. When the fit is OK, glue the balsa supports to the dummy cylinder, but do *not* glue the aluminum tubes in yet or you will have trouble painting the cylinders later. The valve cover is simply a balsa piece sanded to the right shape. Don't glue the tubes and valve cover in place until the cylinders have been painted aluminum.





Above: the almost fully assembled engine (before painting) and the cover piece that represents the front of the crankcase of a radial engine.

Right: the result. If you think the "live" cylinder is the one facing you with the factory "O.S." valve cover, you're wrong! The live cylinder is to the right. I bought an extra valve cover so the top two cylinders (the only ones you really see in detail) would look authentic.

FINISHING UP

The cover piece will represent the front of the radial engine's crankcase. It slips over the real engine's crankcase boss, just behind the propeller drive washer and is attached with a homemade clamp made of 0.020-inch aluminum. I made my cover piece of fiberglass, but you could also solder a 0.005- or 0.010-inch brass cone onto a tube that has a diameter that enables it to just slip over the crankcase boss.

Now you're down to cosmetics. Unbolt the dummy cylinders and remove the aluminum tubes that were installed temporarily. Paint the cylinders aluminum and the A-frame supports black. Paint the balsa valve cover aluminum or black to match the color of the valve cover of your "live" cylinder. Paint the crankcase cover plate black.

If your "live" engine has become discolored from use, you'll want to "antique" the dummy cylinders. Use thinned black or dark brown paint and a small brush to touch up the fins until they match.

The final step is to reassemble the engine. Now you can glue in the aluminum pushrod tubes. Just push one end into the hole in the valve box and, using CA, glue the other end into the supports that you attached to the bottom fin of each cylinder. When you do this, be sure that the tubes of each cylinder are parallel and that the height of the tubes at this support is the same as that of the "live" cylinder.

You can add a little more realism by cutting some 2mm-thick disks from a 3/16-inch wooden dowel. Paint them black and use CA to glue them onto the cylinder heads to represent the head bolts. Paint some of these aluminum, too, to look like the crankcase bolts.

You are now ready to remove everything and build the firewall into the fuselage. When you build the fuselage, it's best to extend a lip of balsa about 1/2 inch beyond the firewall. This will make the engine look "built-in" and will hide the cylinder supports.

You've now saved yourself the cost of a multi-cylinder, radial engine, added only 2.75 ounces to your Stearman PT-17, and your model looks like the real thing. Good flying!

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*

by DON EDBERG

TO PCM OR NOT TO PCM

A LOT OF FOLKS ask whether they should spend the extra bucks for PCM radios. PCM systems do provide some features that are not available otherwise. Are they worth it? Let's start with the basics.

WHAT IS PCM?

To answer this, you first need to understand how R/C systems work. Let's begin with a brief lesson in R/C system operation (those of you who are electrical engineers, please don't write to correct me; the following has been simplified so as to be more easily understood).

The transmitter's control levers and knobs are connected to a series of variable resistors known as potentiometers ("pots" for short). As shown in Figure 1, the transmitter measures the pilot's movement of the controls by measuring the voltage on each of the pots. The difference between Pulse Width Modulation (PWM) and Pulse Code Modulation (PCM) has to do with how the electronics in the transmitter converts those voltages to a radio signal. If you're not familiar with PWM, note that it's often referred to as Pulse Position Modulation—PPM—and also (incorrectly) as FM. So, whenever we refer to PWM transmission, it applies to so-called FM and/or PPM receivers.

In Pulse Width Modulation, the voltages on the pots are broadcast as a series of pulses. As shown in Figure 1, the length of the pulse is directly proportional to the control stick's position. When you move the stick back and forth, the pulse width changes as shown in the channel 4 (CH4) pulse width in Figure 1. Figure 2 shows how the radio frequency part of the transmitter shifts the frequency of the transmission for the top of the pulse and leaves it alone for the bottom of the pulse. The receiver simply converts the pulses back to voltages and sends them to the servos, which move as commanded.

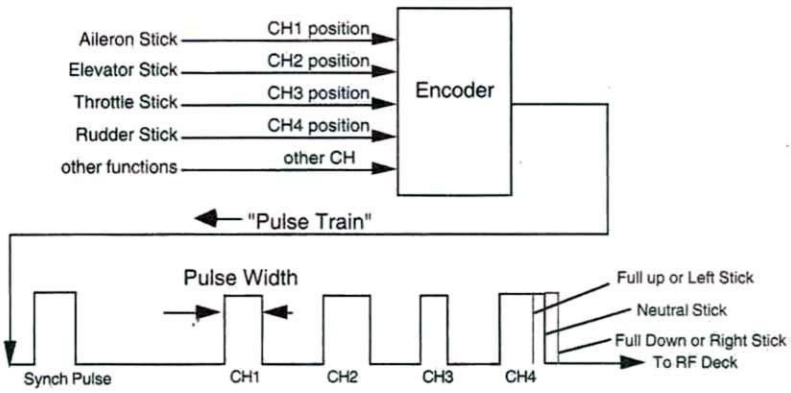


Figure 1. The transmitter creates a "train" of pulses describing the commanded servo positions. Changing the pulse width (note channel 4) changes the servo's commanded location.

In Pulse Code Modulation, the transmitter measures the voltages on the pots and uses a special part called an "analog-to-digital converter" to convert them into *digital* numbers, as illustrated in Figure 3. The transmitter then broadcasts this stream of numbers, and the receiver receives the stream of numbers. The receiver has its own internal computer that deciphers the number stream and changes the commands back to voltages. It then sends them to the servos, which move as commanded.

So, both PWM and PCM make the servos move as the pilot desires. The key difference is that the PCM receiver has to contain a computer to do the number conversion. This computer allows the engineer to design in some interesting features, which have become known as "fail-safe" functions. Therefore, if you only have a PWM receiver (PPM or "FM"), you won't have any of these fail-safe functions, and you need not read on unless you'd like to know what you're missing. (By the way, most transmitters can use their software to switch between PPM and PCM encoding so that you can use both types of receivers if you want.)

SO ... WHAT ARE "FAIL-SAFE" FUNCTIONS?

Now we can answer the question. The computer in the PCM receiver allows several functions that attempt to protect your model in the event that interference is encountered. There are usually two different types of operation that may be selected.

The first interference function is called HOLD, where the receiver holds, or "remembers," where the servos were just before the interference was received and holds the servos in that position. If you're flying straight and level, the plane continues straight and level; if you're looping, the plane continues looping; if you happen to be diving toward the ground when interference is experienced, the plane will ... continue diving toward the ground.

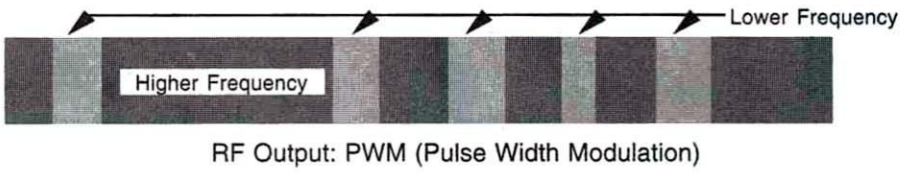


Figure 2. For Pulse Width Modulation (PWM, often called PPM or mistakenly referred to as "FM" transmission), the frequency is changed (shifted up or down) to match the pulse train.

If the interference is steady and continuous, the receiver will just not listen to your transmissions, and you won't have any control. If it does stop, you may regain control before it hits the ground ... or you may not.

The second interference function is called FAIL-SAFE or PRESET. For this one, the operator must define the preferred servo positions before flying. When the receiver recognizes a problem, it goes to its memory, recalls the set of positions that the pilot has programmed in and places the servos into those preprogrammed positions. Many pilots choose to program in slow, straight or gently turning flight. For example, you might choose to set throttle at idle, slight up-elevator and slight aileron to left or right.

Many radios allow you to *individually* choose HOLD or PRESET for each servo! For example, you can order the throttle to move to idle position while at the same time keeping the ailerons and elevator where they were. You might store a full right- or left-rudder command so that if the plane is far away, you'll see it "waddle" from side to side, indicating interference is being received.

PCM receivers may be a Band-Aid for other problems. For example, if linkages or other parts make metal-to-metal contact, a type of interference called "electrical noise" is generated. This might occur on a metal clevis attached to a throttle arm, for example. If the noise is generated whenever there's vibration, the PCM receiver might be constantly turning fail-safe on and off (HOLD function) during flight, which would mask this problem by causing the aircraft to appear to fly smoothly.

I want to repeat now that so-called FM (PPM) receivers cannot perform these functions, but instead, they try to respond to the interference, making the plane appear to fly around crazily. This can be either good or bad, depending on your point of view.

WHAT OTHER FAIL-SAFE FUNCTIONS ARE THERE?

Some PCM receivers have a function called battery fail-safe. With this function, the computer in the receiver keeps track of the airborne battery's voltage. If the voltage drops to a dangerous level, the computer will let you know by automatically moving the throttle servo to the throttle fail-safe position you have set, and you are supposed to notice the loss of power and land as soon as possible, before the battery dies.

That sounds reasonable, but sometimes you need to apply power to make your landing. You can temporarily override the battery fail-safe by moving the throttle stick to idle (all the way to the transmitter bottom) and then moving it up to the desired position. (You should be sure that your throttle fail-safe position is a few clicks above the idle position so it doesn't accidentally die!) However, if you do reset the battery fail-safe, be sure to not forget the warning it was giving and do land at once!

You may choose to fly with a 5-cell receiver battery. Many pilots use them to get faster and stronger servo response. *You must check with your radio manufacturer first to see if your receiver is compatible with the higher voltage!* With a 5-cell pack, you should not plan for the battery fail-safe function to be helpful. Since the receiver doesn't know what battery you are using, the battery fail-safe lets the 5-cell battery get far below a safe level before activating, and it will die in seconds. Therefore, be extra careful to be sure that your 5-cell battery has enough charge to fly safely.

If you're a sailplane flyer without a throttle, it doesn't look like battery fail-safe is very helpful, unless there's a spoiler servo plugged into the throttle channel. The function appears to move the throttle to its *idle* position (whatever that is for a sailplane, hopefully spoilers out!) as before. This is of zero use to most competition sailplanes, which don't use the throttle channel. More useful would be a battery fail-safe that activates the butterfly/crow function, or perhaps pulses rudder or ailerons. There is a device called the "KO-Pilot" that performs just this function. This versatile unit is available from Scanlogic*.

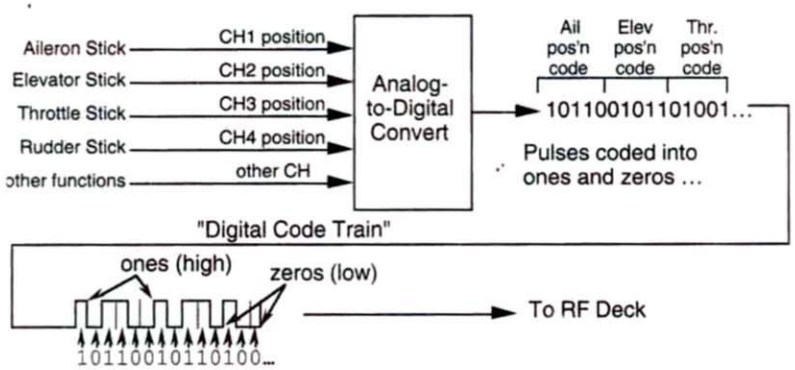


Figure 3. In PCM transmission, the servo positions are encoded digitally as a string of ones and zeros. An onboard computer (in the receiver) is needed to convert these back to servo commands. Frequency shifting is still used to transmit the ones and zeros.

SO ... TO PCM OR NOT TO PCM?

I prefer not to use PCM. Instead of my plane flying along by itself, I would rather know right away that I am encountering interference by observing jerky or strange flight. There have been cases where models have gone into fail-safe mode and crashed, when they might have been saved if the pilot's intermittent commands were followed. Another negative is that PCM receivers are more expensive and not interchangeable between brands.

Instrumented tests have shown that most radio interference is persistent, lasting perhaps 30 or 40 seconds. That is a long time for a model to continue to fly on its own, without any external influences and without running into something or the ground. There is also doubt that PCM receivers are robust

enough to re-acquire the command stream after hard, sustained interference. Some people believe that the advantages claimed for PCM are overrated and suspect. I tend to agree with this assessment. As I said earlier, I prefer to use "FM"/PPM/PWM receivers.

I can think of one good use of fail-safe settings, and that was when I was transmitting the picture from a video camera down to the ground using an airborne transmitter. I mounted an airborne video camera and a 1W downlink transmitter right next to my heavily shielded R/C receiver, and I was concerned about the video signal interfering with the receiver. I set the fail-safe command to switch off the video transmitter if any interference was encountered. As it turned out, there was no problem with the airborne receiver, but it would have shut it off automatically if there had been. By the way, I had modified this Futaba* receiver by wrapping it with special shielding tape, and I connected the antenna through a special electronic filter.

WHY DO PCM SYSTEMS COST MORE?

I mentioned earlier that most transmitters can transmit in both PWM and PCM modes. Normally, you use the system's menus to choose which type. So, the only difference is the receiver supplied with the systems (and possibly the number and type of servos as well). The major difference between receivers is the onboard computer. This computer is the major reason why PCM receivers and systems cost more than non-PCM ones. And, since each brand of radios uses its own PCM encoding scheme, the PCM receivers are not interchangeable between brands, unlike non-PCM receivers (between certain brands, anyway).

Remember, if you write, send your self-addressed, stamped envelope to Don Edberg, 4922-M Rochelle Ave., Irvine, CA 92604, or you can email me at my new email address, <dynamic3@flash.net>. I get lots of mail, so please be patient!

Addresses are listed alphabetically in the Index of Manufacturers on page 182.

MODEL AIRPLANE NEWS

PRODUCT REVIEW

Great Planes
Pro Glue-B-Gone

by STAN KULESA

Like many of you, I have a tendency to get glue on my fingers when I build. These dried pieces of cyanoacrylate give the appearance of scales of skin and take a day or two to fall off naturally unless you take the time to scrub with a rag and some debonder or other chemical. This becomes a nuisance, especially when clean hands are a must for work, worship or leisure.

Great Planes* discovered a solution and has released the PRO Glue-B-Gone brick. It measures 3¾ inches long by ¾ inch thick by 1½ inches wide and weighs about ½ ounce. It is marketed as the "non-chemical alternative for removing dried glue from fingers." The Glue-B-Gone brick is made of a hard, white, pumice-like material.

To use it, you lather your hands with warm water and soap. Then you firmly rub the Glue-B-Gone brick over your hands and fingers to remove the dried cyanoacrylate glue. I have found that it is also effective with other types of dried glues (Ambroid, plastic cement, etc.).

The next time you reach to scratch an itch in the corner of your eye and the scales of glue on your fingertip make it a painful experience, think of this product.

The Glue-B-Gone brick represents the easiest and safest way to remove modeling adhesives from fingers and hands with no smelly chemicals. It is one of those "new fangled contraptions" that really works!

**Addresses are listed alphabetically in the Index of Manufacturers on page 182.*

LATEST PRODUCT RELEASES

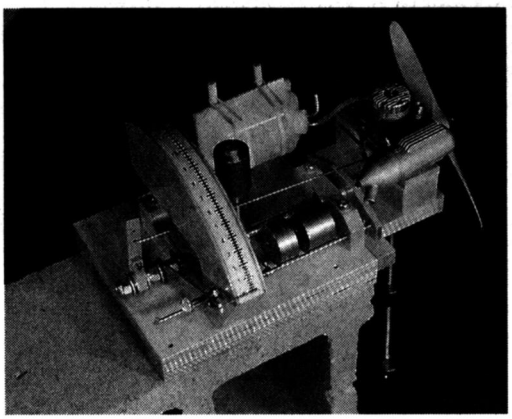
K&A MODELS UNLTD.

Spitfire Mk 24

This Speed 400 model kit features an epoxy/glass fuselage, cut tail surfaces, a clear canopy, vacuum-formed accessories, precision-cut wing ribs, all necessary wood, full-size plans and building instructions. Specifications: wingspan—30.5 inches; wing area—163 square inches; wing loading—18 to 20 ounces per square foot; weight—20 to 22 pounds.

Part no.—10120; **price**—$69.99 plus $6.99 S&H.

K&A Models Unltd., 9300 Yvonne Marie Dr. N.W., Albuquerque, NM 87114; (505)890-7549; fax (890)7532.



AMERICAN HOBBY PRODUCTS

Dyna-Torque

This tool will measure the torque produced by 2- and 4-stroke engines of .049 to .90ci. It features a dual, ball-bearing-supported, 12-inch-diameter pivot shaft and contains a five-piece weight set that permits four ranges of torque values. All assembly hardware is included, as is a Sullivan 6-ounce flex tank for use with the vibration-isolated, adjustable tank support. A toggle throttle device provides positive set throttle control.

Price—$129.

American Hobby Products, 12 West Hill Cir., Reading, MA 01867; (617) 944-8316; fax (617) 944-3585.

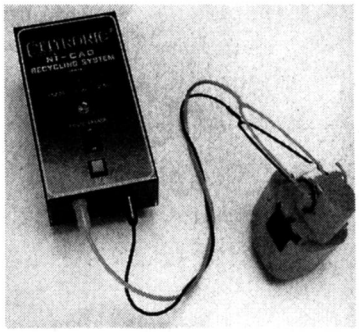
KYOSHO

PT-19 ARF

This model is ready to fly after just a few hours of assembly. Specifications: wingspan—61.7 inches; wing area—567.4 square inches; weight—6 pounds; fuselage length—47.6 inches; engine required—.32 to .40 2-stroke or .48 to .53 4-stroke; radio required—4-channel with five servos.

Part no.—KYOA1035; **price**—$369.99.

Kyosho; distributed by Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008; website http://www.hobbies.net/kyosho.



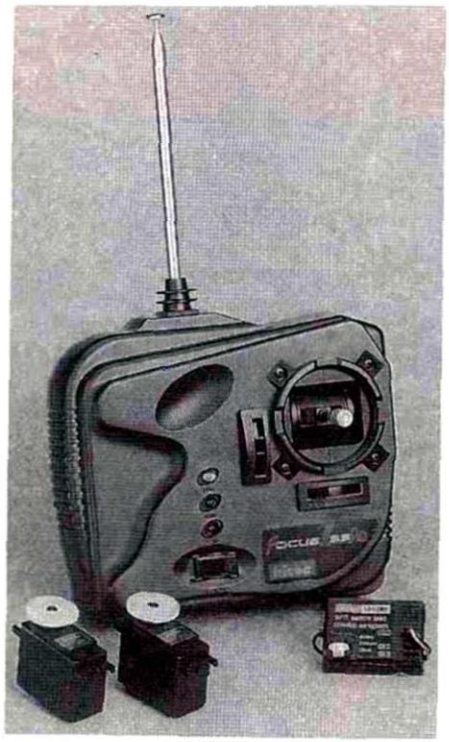
THE BATTERY WORKS

Celtronic Battery Saver System

This battery recycling system features deep-cycle discharge circuitry; Smart Port cable hookup jacks; and universal, adjustable battery connection cables. It's designed to work with the factory charger supplied with your battery and doesn't require an external power source. It can service at least 80 Ni-Cd rechargeable batteries per month. Voltage: 1.2 through 15 volts, 100mAh through 24Ah.

Part no.—CNR-1; **price**—$139.

Battery Works, 525 S. Calapooia, Bldg. 2-A #F, Sutherlin, OR 97479; (541) 459-5550; fax (541) 459-5650.



HITEC RCD INC.

Focus

This single-stick, 2-channel radio features servo-reversing, standard trim levers on the dual-axis, sealed gimbals and a three-level signal-strength indicator. It comes with a receiver, an on/off switch harness and two HS-300 servos. It also features a Ni-Cd charging jack on the transmitter.

Part no. 145721; **price**—$99.95.

Hitec RCD Inc., 10729 Wheatlands Ave., Ste. C, Santee, CA 92071; (619) 258-4940; fax (619) 449-1002.

ALBATROS PRODUCTIONS LTD.

Windsock Datafiles

With an authoritative look at aircraft of WW I, these books provide photo support for a modeling project, historical information on the topic aircraft, and even construction and color information. Three-views are included, generally in 1/72 and 1/48 scales. Appendices provide production details, specifications and performance information. Recently released volumes 59 and 60 feature the Pfalz E. I to E. VI and Sopwith Baby, respectively.

Price–$17.50 *each.*

Albatros Productions Ltd.; distributed by Wise Owl Publications, 4314 West 238th St., Torrance, CA 90505-4509; (310) 375-6258; email wiseowl@sprintmail.com.

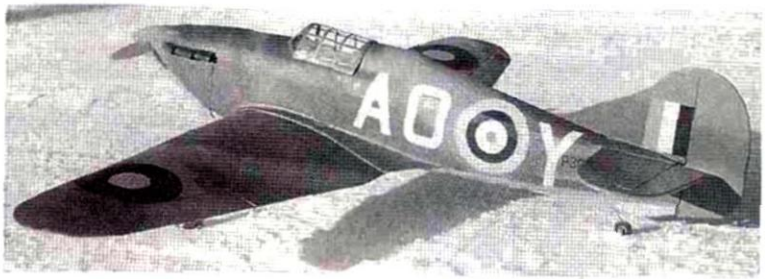
IKON N'WEST

Hawker Hurricane

With a 62-inch wingspan, this model can be powered by a .50 2-stroke or .80 4-stroke and features balsa and ply hand-cut parts, a fiberglass cowl and clear canopy. It comes with full-size drawings.

Price—$179.95 plus $8 S&H.

Ikon N'West, P.O. Box 306, Post Falls, ID 83854; (800) 327-7198 or (208) 773-9001.



GREAT PLANES

Wheel Standoffs

These 5/32-inch, all-metal wheel standoffs prevent wheels from hitting the landing-gear wires during landings. They're more secure than a wheel collar, and you need only crimp them around the landing gear wire and use solder or medium CA to hold them in place.

Part nos.—*GPMQ4266* (3-pack), GPMQ4267 (12-pack); **prices**—$.89, $3.59.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008; website http://www.hobbies.net/gpm/.

DYNAFLITE

Field Box

This new, fuelproof, polyethylene plastic carry-all will keep all your field accessories organized and accessible. It has a 12x7-inch drawer and an open storage compartment on top. The end shelves carry a 1-gallon jug of fuel and a 12V battery. The Field Box will hold any standard power panel and a starter, starter battery and fuel pump.

Part no.—*DYFP7310*; **price**—$59.99.

Dynaflite; distributed by Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008.

Name THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

Congratulations to Dan Lutz of Fallbrook, CA, for correctly identifying the July '97 mystery plane as the Luscombe Model 10. This single-seat, low-wing cantilevered monoplane was featured on the cover of the September '46 issue of *Model Airplane News*. The plane was of all-metal construction except for its fabric-covered wing; it had an aluminum monocoque fuselage and was powered by a 65hp, 4-cylinder Continental engine. The aircraft had a 25-foot wingspan, was 17 feet long and weighed 845 pounds, loaded. Its maximum airspeed was more than 135mph, and it had a cruising speed of 122mph.

Send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free one-year extension of his subscription.

CLASSIFIEDS

BUSINESS

SCALE AIRCRAFT DOCUMENTATION and resource guide. Larger, updated 1997 edition. World's largest commercial collection. Over 6,400 different color Foto-Paaks and 35,000 three-view line drawings. 204-page resource guide/catalogue—$8; Canada—$10; foreign—$15. Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [3/98]

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AERO FX BY JO DESIGNS—exact-scale, computer-cut, high-performance vinyl graphics and paint masks. Lettering; nose art; insignia for scale; pattern, pylon and sport fliers; complete graphic sets available. Call or write for free sample and catalogue. JO Designs, Rt. 1, Box 225 AA, Stratford, OK 74872; (405) 759-3333; fax (405) 759-3340. [11/97]

GIANT-SCALE PLANS BY HOSTETLER. Send SASE to Wendell Hostetler's Plans, 1041 Heatherwood B, Orrville, OH 44667. Phone (330) 682-8896; fax (330) 683-5357; http://www.aero-sports.com/whplans. [6/98]

SODA-CAN AIRPLANES—replica biplane detail plans with photos, $7.50 PPD. Early's Craft, 15069 Valley Blvd. SP 26, Fontana, CA 92335. [8/98]

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SUNGLASS DISCOUNTS—Serengetti, RayBan, Randolph, Vuarnet, Gargoyles, Bolle, Revo, Hobie. Free catalogue. FJS Accessories, (800) 226-7571. [11/97]

GEE BEE PLANS used for full-scale R-2, "Z." Ten airplanes, ⅓-½4. Catalogue/News $4. Vern Clements, 308 Palo Alto, Caldwell, ID 83605; (208) 459-7608. [12/97]

LARGE-SCALE SAILPLANES AND TOWPLANES—new and used—call (212) 879-1634, Sailplanes Unlimited, 63 East 82nd St., New York, NY 10028. www.sailplanes.com. [11/97]

R/C SKYDIVING: Thrilling free-falls, chute opens by transmitter. Parafoil Parachute duplicates all canopy maneuvers, turns, stalls, spirals, landing flares, etc. Latest catalogue $1. R/C Skydivers, Box 662M, St. Croix Falls, WI 54024. [10/97]

PLANS—R/C sailplanes, scale, sport and electric. Old-timer nostalgia and FF scale and sport-powered, rubber and towline. All models illustrated. Catalogue $2. Cirrus Aviation, P.O. Box 7093, Depot 4, Victoria, BC V9B 4Z2 Canada. [3/98]

MAKE REAL DECALS with your computer and printer. Send $10 for introductory kit to LABCO, Dept. MAN, 27563 Dover, Warren, MI 48093. http://www.mich.com/~labco/. [3/98]

NEW ZEALAND AERO PRODUCTS. Scale plans: Agwagon, Airtruk/ Skyfarmer, Pawnee, Pawnee Brave, Fletcher FU-24, DC-3/C-47, Cessna 152 Aerobat, Hall's Springfield Bulldog, Fairchild PT-19, Fleet PT-26, Rearwin Sportster, Typhoon and more. Hardware packs, color photo packs available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand. Phone/24 hr. fax: 643-2128192. [3/98]

WW I PLANS. Over 600 in stock. Laser-cut parts. Printed lozenge tissue. Send $5 for illustrated catalogue to Clarke Smiley, 23 Riverbend, Newmarket, NH 03857. [10/97]

FLYRITE BUILDING SERVICE. Experience in fine detail and craftsmanship of any kit. Top Flite, Great Planes, Midwest, Goldberg, Sig, etc. From box to air. (513) 755-8894. [2/98]

SAITO ENGINE REPAIRS. Now available at A-Train Hobby by the Oldtimer. Other gas engine repairs also available. A-Train Hobby, 13503B Southeast Mill Plain Blvd., Vancouver, WA 98684; (360) 944-5403. [11/97]

PRESSURE JET ENGINE GLUHAREFF G8-2 5 lbs. to 40 lbs. thrust, plus. Push-button starting. No moving parts. Propane powered. Successful multiple uses. 16-page, illustrated catalogue, $5. Jet Wind Co., 1624 Burnett St., Long Beach, CA 90806; (562) 427-2655, (213) 258-9313; fax (562) 427-3126. [11/97]

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DETHERMALIZING CERTAINTY. For most free-flight models. Weighs .7 to 1.2 grams. Large SASE to Wheels & Wings, P.O. Box 762, Lafayette, CA 94549-0762. [10/97]

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NORTHWEST AG AIRCRAFT is the U.S. agent for New Zealand Aero Products' fine line of scale plans, documentation, and new fiberglass accessories. Call or write for a catalogue of these award-winning Ag aircraft and many more! Only $5. Route 4, Box 575-28, Astoria, OR 97103; phone/fax (503) 458-6686. [12/97]

MAKE YOUR OWN ROCKET MOTORS!!! Homemade solid and composite fuels power R/C gliders, model rockets, etc. Smoke tracers for R/C planes & choppers, electric igniters, cannon fuse "chemicals," lab acids, glassware, "How-to" Books, videos, rocket motor kits, "huge" catalogue $2. Pyrotek, P.O. Box 300, Sweet Valley, PA 18656; (717) 256-3087. [2/98]

ELIMINATE CARBON, VARNISH AND OVERHEATING PROBLEMS and reduce engine wear with QX-500 R/C Fuel Treatment. Send $1 or 3 stamps for sample. LubeTech, 10620 Nevada St., Melrose Park, IL 60164. [11/97]

PLANS-ENLARGING SOFTWARE—PLANS ENLARGING. Old magazines, scanning, plotting. Free information. Concept, Box 669A, Poway, CA 92074; (619) 486-2464. [11/97]

HELICOPTERS-BOLAR HELI RESEARCH: We build your heli, test your heli, repair your heli. Complete construction with new or your equipment. Also, the best prices on helicopter kits, radio systems (Airtronics, Futaba, JR), engines and exhaust systems. Bolar Heli Research, 322 N. 7th St., Lehighton, PA 18235; (610) 377-4941; email bolar@mail.ptdprolog.net. [12/97]

LANDING GEAR PLANS: Build functional, spring-loaded gear for any size model. Send $7.50 shipping and handling to Jesse Lyon, 22 Metro Trail, Hopatcong, NJ 07843. You will never use conventional gear again! [12/97]

PULSEJET ASSEMBLY PLANS: Build a functioning pulsejet from easy-to-obtain, economical parts. Components are also available. Send $19.95 plus $2.50 s/h by check or money order for complete set of CAD drawings to Unitool Inc., P.O. Box 504, Elkhart, IN 46515. [1/98]

PINS, PATCHES, BADGES: Club memorabilia, embroidered emblems, hats, hat tacs, name badges, placards, signs and awards. Generation Products Co., (800) 472-5155. [10/97]

FIGHTER WIND VANE PLANS. Details. Large SASE. Airmodel, Box 72, Ocala, FL 34478-0072. [12/97]

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LASER CUTTING. I now have a laser of my own and have parts for many of my plans laser cut. Have parts for many WW I plans and will have the CAD files for many more soon. Have 6 catalogues of plans available. Call for information or card orders. US agent for Nexus for about 30 years. Bob Holman, P.O. Box 741, San Bernardino, CA 92402; (909) 885-3959. [10/97]

HOBBYIST

MAGAZINE BACK ISSUES—*American Modeler, American Aircraft Modeler, Aeromodeller, Model Airplane News, Model Aircraft, RCM* and more; 1930s–1990s. For list, send SASE to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [3/98]

WANTED: Built or partially built scale Cessna 150, 152, or 172. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; phone (714) 768-0585; fax (714) 458-6455. [10/97]

WANTED: Model engines and racecars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [10/97]

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [11/97]

MODEL AIRPLANE NEWS, 1930-1980; "Air Trails," 1935-1952, "Young Men," 1952-1956; "American Modeler," 1957-1967; "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C., Canada VOR 1L1. [3/98]

PAYING $150 EACH FOR TOY OUTBOARD MOTORS: Mercury, LePage, Orkin, Oliver, Scott, Fuji, Sea-Fury Twin, Evinrude, Gale, Johnson. Gronowski, 140 N. Garfield Ave., Traverse City, MI 49686; (616) 941-2111. [11/97]

WANTED: Old, unbuilt, plastic model kits from '50s and '60s. Send list, price to Models, Box 863, Wyandette, MI 48192. [3/99]

USED ENGINES WANTED. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [8/97]

FOR SALE: Winch with brake, foot switch, turnaround, about 2,000 ft of line, parachute, stakes, maintenance-free battery with bladeswitch. $350. (541) 382-1498. [10/97]

WANTED COX GAS POWERED: cars, planes, boats. Paying $50 each. Dean Barham, 4032 Iowa, San Diego, CA 92104; (619) 528-1680. [11/97]

WANTED: Futaba single stick helicopter radio. Complete system or transmitter only. (814) 825-8404. Bob Vomero. [2/98]

WANTED: Model engines Phantom P-30. All models excellent or new condition. Premium prices paid. Richard Willey, 3506 Kathleen Ann, Mattese, MO 63129. [10/97]

WANTED: Book titled "Mustang Designer" by Wagner. State condition and price. Raymond Leone, 219 N. Jefferson St., Batavia, IL 60510. [10/97]

WANTED: Plans and instructions for Marutaka Cessna L-19 Bird Dog kit. Mike Gosselin, 10 Rivercove Dr., Cromwell, CT 06416; (860) 635-0413. [11/97]

HELP. Need piston engine and ring for SuperTigre 2000. If you have crashed engine but piston survived, drop me a line. John Callahan, 430 E. Gaywood, Houston, TX 77079. [10/97]

EVENTS

RELIVE 30 SECONDS OVER TOKYO!! Your chance to own a fabulous twin engine B-25 made by Wing Manufacturing! A dream prize worth more than $1,500 consisting of this fantastic kit complete with engine and machine gun details, two (2) Saito Gold Knight .56 4-stroke engines, JR XP642 Computer Radio, complete Robart pneumatic retract system, Coverite aluminum covering, Du-Bro wheels and hardware package will be raffled at the Midwest's largest RC Swap Shop and newest EXPO! This event is sponsored by the Hobbytime Flyby Knights, AMA 3763, on Sunday, October 26th, 1997, in the main exhibition hall at the DuPage County Fairgrounds, Wheaton, Illinois. Raffle tickets are $1 each or 6/$5. Raffle or admission tickets may be purchased by mail/phone/fax or in person at the EXPO. Credit cards accepted for tickets or Exhibit Spaces. Call (630) 837-8437/fax: 7239 or mail your order to Hobbytime Flyby Knights, Hangar 369, 369 Army Trail Rd., Bloomingdale, IL 60108. Winner need not be present. [11/97]

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ADVERTISER INDEX

CYPHER...UFOs ARE REAL

FROM EXPERIENCE in R/C modeling, it became apparent to the Sikorsky Cypher® Unmanned Air Vehicle (UAV) team that missions out of the range of sight would require some serious technology. This problem is addressed with a sophisticated computer on board the aircraft. Unlike sport R/C computer radio systems, the Cypher onboard computer performs more tasks than simple control mixing. This computer is responsible for all the piloting,

The pod on top of Cypher has a suite of electro-optical (EO) sensors, including TV and infrared cameras, acoustic sensors and motion-detection logic associated with the video. The pod configuration is used as a remote ground sentry for security.

and the operator on the ground supplies only decision making. With this arrangement, there are no worries about radio failure. When the radio fails, the Cypher UAV flies itself home and lands.

The Cypher UAV construction is very high tech. The airframe is made of carbon fiber, and it has a diameter of 6.5 feet. Cypher weighs 250 pounds. It has two counter-rotating, four-blade rotors inside the shroud. The rotors are of modern, bearingless construction and are made of carbon fiber. Each rotor has a conventional helicopter swashplate with its own set of servos. The counter-rotating main rotors eliminate the need for a tail rotor. Yaw is controlled with differential collective on the two rotors. The aircraft has a UAV Engines 52hp rotary engine mounted within the airframe, providing a load-carrying capacity of 40 pounds and a cruise speed of 80 knots. A drive shaft transfers power to a transmission located between the rotors.

During early development work, a conventional looking controller box was used. This box has been replaced with a computer work station called the "Sikorsky System Manager." The System Manager consists of a digital map of the area, buttons for automatic takeoff, landing, and cruise and controls for the aircraft's sensors. Before the aircraft is launched, a flight plan is created by using the mouse to click on points on the digital map. This route plan is uploaded to the aircraft over a digital data link.

The aircraft has many potential uses. So far, only a small percentage of these possibilities have actually been demonstrated.

Sikorsky has performed a series of tests for the Department of Energy (DOE). The DOE is interested in using the aircraft to find things buried under the ground. Their equipment package consists of three magnetometers, which are sensitive instruments for measuring magnetic field. When any ferrous metal is nearby, it disrupts the local magnetic field. The Cypher UAV flies itself in an evenly spaced grid pattern to sweep the magnetometers over an area. Readings from the magnetometers are sent along with aircraft position over a radio link, so a map can be generated showing where things are buried. Using this technique, the Cypher team has found buried structures 200 feet underground! Its capabilities have also been used to detect unexploded artillery shells and will be upgraded to detect land mines.

The most impressive demonstration

In this configuration, the aircraft is sent out to the perimeter of a military encampment, landed and shut down. It uses its sensors to detect intruders or equipment. Video and information are relayed back to the control station. On completing the mission or detecting a threat, the aircraft starts up, takes off and flies home. Here, Cypher is moving down a street as part of a demonstration at Ft. Benning.

of the Cypher's capabilities took place in September, 1996. In this demonstration, the operator used the System Manager to send the aircraft out to search for and track a person. A night vision sensor (infrared camera) was mounted on the side of the aircraft. The carbon-fiber mounting assembly allowed the sensor to look forward, backward and anywhere in between. The video from this sensor was fed to an Automatic Target Recognizer, or ATR. Its job was to tell whether there was a person in the picture and to estimate where that person was located. As the person walked around, the ATR fed the information to the aircraft so the person stayed in the center of the picture. The other technology used in this demonstration was a route planner, which told the aircraft how to move from one location to another without running into anything.

The real future for the Cypher UAV and its technology lies in hazardous missions. All of us in the sport of R/C know the trauma of losing a model, but compared to the loss of human life, it is really not significant. The Cypher UAV's ability to fly itself, do surveillance, map out minefields and accomplish other hazardous tasks means that a person is spared from that danger.

—Byron Cotton